

HISTORY OF BANGLADESH

Early Bengal in Regional Perspectives
(up to c. 1200 CE)

Vol. 2

SOCIETY ECONOMY CULTURE

Foreword by Romila Thapar



EDITORS

ABDUL MOMIN CHOWDHURY

RANABIR CHAKRAVARTI

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CONTENTS

Project Implementation Committee	
Editorial Board	<i>vii</i>
A Note on Diacritics	<i>viii</i>
Contributors	<i>ix</i>

SOCIETY

1. Everyday Life in Early Bengal	3
Suchandra Ghosh and Sayantani Pal	
2. Social Life: Issues of Varṇa-Jāti System	43
Ryosuke Furui	
3. Social Life of Women	71
Shahanara Husain	
Appendix I	
Social History of Women in Ancient Times:	91
Emergent Methodological and Historiographical Issues	
Nupur Dasgupta	

ECONOMY

4. Economic Life: Agrarian and Non-Agrarian Pursuits	109
Ranabir Chakravarti	
5. Agricultural Technology	197
Md. Shahinur Rashid	
6. Media of Exchange: Reflections on the Monetary History	233
Susmita Basu Majumdar	

CULTURE

7. Brahmanical Religions	271
Kunal Chakrabarti	
8. Buddhism	297
Sarita Khettry	

9. Jainism	313
Nupur Dasgupta	
Appendix II	341
The Ājīvikas in Eastern India and Bangladesh	
Susmita Basu Majumdar	
10. Terracotta Art	353
Sima Roy Chowdhury	
11. Sculpture	369
Asok K Bhattacharya	
12. Brahmanical-Buddhist Sculptures: Looking for 'Bengal'ness	391
Jinah Kim	
13. Brahmanical Iconography: Aspects of Form and Meaning	433
R. Mahalakshmi	
14. Iconography of Stone Sculptures	445
Gouriswar Bhattacharya	
15. Architecture	475
Ganapathy Subbiah and Remya V.P.	
16. Illustrated Buddhist Manuscripts	509
Jinah Kim	
17. Sanskrit Literature and Technical Treatises	535
Nupur Dasgupta	
18. Caryāpada	591
Syed Mohammad Shahed	
19. Origin and Development of the Bangla Script	607
Shariful Islam	
20. Bengal and Southeast Asia: Commercial and Cultural Linkages	623
Aksadul Alam	
Appendix III	
Buddhist Cultural Linkages between Bengal and Southeast Asia	647
Suchandra Ghosh	
Bibliography	665
Abbreviations	698
Index	699

5

AGRICULTURAL TECHNOLOGY

Md. Shahinur Rashid

Bengal's geographical location, favourable climate and geo-physical condition as also the success of the farmers in utilising the conditions have led to the development of agriculture to become the main source of its economy and capital formation. From early historic period to the present the role of agriculture has been very significant. Using their own skill-based technology Bengali farmers have demonstrated their own creativity in selecting land, grain and time for cultivation, ploughing land, irrigation, saving the crops from the attack of insects, using fertilisers for increasing production, collecting and preserving seeds, thrashing, husking, transporting crops, production of oil from oil seeds etc. Certainly, their knowledge, technology or engineering skill have been acquired over a long period of time. Out of necessity Bengal's farmers used the fields as laboratory and invented new techniques and devices, utilised them and modified them. In this way Bengal's agriculture, keeping a close connection with the people and the nature of this land, satisfied the need, of the people and kept its development an ongoing process. So, in the study of socio-economic history the importance of the study of the techniques of production cannot be underestimated. Besides, the source of the effective technologies that the farmers of Bengal used in every step of the evolutionary process, the impact of those technologies on their life are very significant for understanding Bengal's socio-economic history.

Though agricultural technology is very closely related to human life, it has failed to draw the attention of the historians. Apart from the question of outlook, scarcity of information¹ on agro-technology may be the main reason for the lack of study on the subject. Except archaeological artifacts and contemporary literature (literary works, copper plates, foreigners' accounts), no other sources have been used in the reconstruction of the history of Bengal. But Niharranjan Roy has shown that by using 'other sources' a new horizon for the study of the socio-cultural history of Bengal can be opened up.² The most important of the 'other sources' is archaic words.³ An attempt will be

made in this chapter to reconstruct the history of Bengal's traditional agro-technology using archaic words of Bāṅglā and their etymology.⁴ In this regard *Kṛṣiparāśara*,⁵ written by Ṛṣi Parāśara before the 11th century CE, is an exceptional source and some other literary works and archaeological artifacts may help us to reconstruct the history of agricultural technology.

Background

The development of human society from 'Food Gatherer' to 'Food Producer' happened as a result of the invention of agriculture. Bengal was no exception. But when did this development happen is unknown to us. It is said that human beings started collecting seeds and produce crops from those seeds. Once they were sure of producing basic food they ceased to be hunters and turned to be farmers. Giving up nomadic life they settled down to group-life, and established houses. In the Neolithic age, human beings learned to identify such type of crops that do not scatter their seeds when they are ripe. Sowing those seeds, selected through practical observation, in their own land they started to grow crops. In the Neolithic age agriculture was practiced in Bengal and proof of cultivating rice is evident in Bihar, Bengal and some places of Odisha. In the Iron age, proof of cultivating rice and oil seed has been found. The agricultural products of that time were different types of rice, oil seed, cereals, different vegetables, such as, pumpkin, cucumber, sugar cane, cotton etc.⁶ Cinders of burnt rice have been found from Mahishdal (1380-855 BCE) of West Bengal.⁷ Terracotta plaques of first century BCE depicting harvesting festival have been found in Chandraketugarh.⁸ Mention of rice and oil seed has also been found in the Mahasthan stone inscription (3rd century BCE).⁹ In Maurya period the use of iron made implements spread in the cultivation of paddy in Bengal.¹⁰ In the 2nd century BCE Patañjali mentioned that water was found by digging well in the ground and that water was highly beneficial.¹¹ The reference to rice is found from the Chinese traveler Xuan Zang¹² and a contemporary copper



Harvesting festival depicted in a plaque from Chandraketugarh.

plate records the existence of a village where mustard was cultivated.¹³ In the Sena epigraphs there are mentions of rice and rice cultivation.¹⁴ In *Khanār Vacan*¹⁵ there are mentions of different kinds of agricultural products, processes of cultivation and irrigation in the compilation of proverbs.¹⁶ Information on agriculture is also present in the writings of Kālidās¹⁷ and Sandhyākaranandī.¹⁸ Besides the *Amarakoṣa* mentions twelve categories of land and among them the last two are *Nadīmāṭrk* and *Devamāṭrk*.¹⁹

The above information on agriculture indicate that tilling of the soil was necessary to grow crops of different types and qualities. There is no doubt that this was done by using very effective technology. In *Khanār Vacan* we find mention of irrigation; Patañjali mentioned digging of well for water and in the Khalimpur copper plate there is mention of a bundh (*āli*) constructed by the Yuvarāja Devaṭa. From these it can be assumed that there was need for irrigation in ancient Bengal. The mention of a granary in the Mahasthana Brāhmī Inscription indicates that there were arrangement for the preservation of seeds. Even in *Kṛṣiparāśara* we find the advice: ‘*suphasaler mul halo uttam vij*’ (Better seeds, better crops).²⁰ Rāmāi Paṇḍit wrote in the *Śūnya Purāṇa* that Śiva went to Durgā and demanded seeds to cultivate rice. In *Śūnya Purāṇa* we find the following: ‘*dahar dāṅgar sab akui susar*’, which means that the sown seeds were big and nutritive.²¹ So it can be said that in ancient time there was proper management for the preservation of seeds. In ancient Bengal rice and mustard were the main crops and staple food of the people was rice. In the early medieval period rice and oil were exported from Bengal to different countries. Based on this information it can be said that the people in ancient Bengal had the technology of preparing rice from paddy and of preparing oil from different oil seeds like mustard and sesame.

Ploughing Technology

There are three important stages in the history agriculture. In the first stage agriculture was hoe-based, which in the second stage was plough-based.²² In the third stage, an iron-coulter was added to the plough. All these three stages were revolutionary changes, that brought great transformation in the economic condition of the society as well as qualitative changes in the material aspects of life and in the socio-political institutions.²³ After a few millenniums at present the wooden ploughs have become synonymous to the backwardness of agro-economy. For that reason, at present it may not be possible to realise the contribution of the plough in the evolution of human civilisation. But in the history of human civilisation the transformation from pre-plough agriculture to plough-based agriculture was a fundamental shift.²⁴ It also needs to be emphasised that adding iron coulter to the plough ended the pre-Iron age and

started a new age in which came the use of various kinds of tools connected with production, such as, spades, sickles, axes, hammers etc. All together the production capacity of the society reached a new height.²⁵ It cannot but be said that like other regions of the world Bengal also witnessed similar development of its agriculture. How far did this development spread? Whether it was limited to the hilly areas or did it spread in the plains? Because of Bengal's geographical location and climate, was it was possible to introduce agriculture by cutting down dense forest and clearing the areas without using Iron implements? It is difficult to answer these questions with certainty.

Though there is no controversy among historians regarding the beginning of agriculture, but there are two different opinions regarding the expansion of agriculture. However, both the schools agree that before the invention of the plough agriculture did not witness extensive expansion, and it was after the attachment of the iron coulter to the plough the expansion of agriculture was rapid and extensive. Most of the historians agree that even before the coming of Brahmanic culture into Bengal agriculture was the main occupation of the people. But they did not say it exactly that the use of plough attached with iron coulter was in vogue before that time.²⁶ Another group of researchers believe that agricultural expansion in Bengal took place after the spread of the Brahmanic culture, when the jungles were cleared by using iron implements and facilitated the extensive expansion of agriculture. At that time, the iron-coulter was added to the plough. They are of the opinion that Bengal's agriculture was hoe-based before the coming of Brahmanic culture and they were the pioneer of plough-based agriculture.²⁷ But it is true that plough-based agriculture driven by cattle, brought a revolution in the expansion of agriculture.

The plough first appeared in Mesopotamia in c. 3000 BCE.²⁸ In the Indian subcontinent plough is found in the Indus Civilisation and in the Vedic literature (Fig. 1). The plough is nicely presented in the Gandhara Relief Sculptures of c. 200 BCE (Fig. 2). MS Randhawa found similarity of the plough of the Gandhara region with the plough of the 20th century Himachal Province



Fig. 1: Terracotta toy plough, Indus Valley civilisation, after M.S. Randhawa, 1980.



Fig. 2: Plough in Gandhara Art after M. S. Randhawa, 1980.

(Fig. 3). He also found similarity with the artifacts of Java (Fig. 4). There is no difference between the ploughs of Gandhara, Himachal, Java and the ploughs of

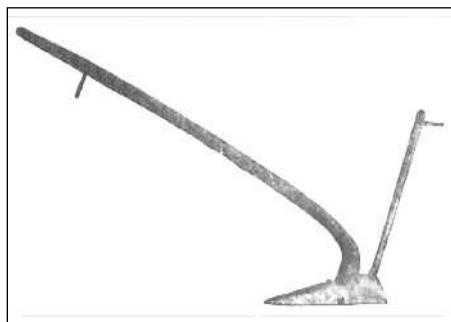


Fig. 3: Plough in Himachal, India
after M.S. Randhawa

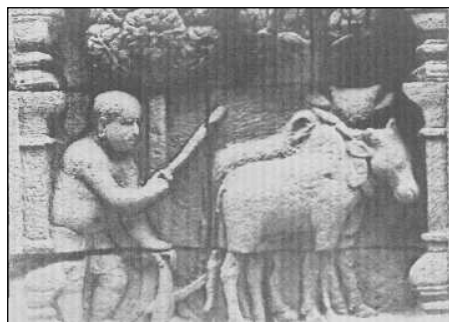


Fig. 4: Plaque depicting Ploughing scene in
Java, after M.S. Randhawa.

present day Sylhet of Bangladesh (Pl. 1). The basic structure of the plough is same even in the Egyptian paintings (Pl. 2). From the beginning of agriculture till the 20th century Bengal's agriculture was totally dependent on the traditional plough, but its shape varied at different times. At the initial stage, it was like a hoe with a stick, which was mainly used in '*jhum*' agriculture. Atul Sur has given an explanation of the invention of tools for tilling the soil. It is believed that in the primitive society women were the inventors of the process of producing crops. Since the female knew the process of producing child, they started tilling the soil with a stick shaped like the male sex organ.²⁹ Here two things need to be mentioned: (i) It was known to everybody that the ploughs were pen-shaped in its primary stage and the primitive agriculture was called hoe-agriculture. Tools used for *jhum* agriculture are still the same;³⁰ (ii) In almost all religions females are considered as '*kṣetra*' in the context of producing child.³¹ So it is not unlikely that there is some connection between '*liṅga*' and '*lāṅgal*'. So, it can be said that the plough has come to attain a particular shape based on its practical usefulness (Pl. 3).

The plough in Literature: In the *Kṛṣiparāśara*, written in Bengal or Eastern India, there is a description of Ox-driven plough. Especially in that description are the names of eight different parts of the plough, which are very important in the history of the evolution of the plough.³² Besides in the *Śūnya Purāṇa* (Chapter *Atha-Cāṣa*) there are mentions of the plough, *fāla* (iron coulter), *mai* (ladder), *joāl* (yoke) etc. for the cultivation of paddy.³³ In *Khanār Vacan*,³⁴ there are plenty of information on *lāṅgal*, *hāla* and *Cāṣa*, spread all over the text.

In spite of the fact that we do not get any clear idea about the shape of the plough from the above literary sources of the early and early medieval periods, it seems that the shape of the ancient plough was not far different from the modern

one. However, archaeological objects also prove the existence of plough in Bengal and give us some idea about its shape. In a terracotta plaque (8th-9th century CE) found at Somapura Mahāvihāra in the Naogaon district of Bangladesh there is a depiction of a peasant with a plough on his shoulder.³⁵ Recently a Terracotta plaque has been discovered from excavation at the Ranir Banglow Dhibi in Comilla on which is depicted the scene of a cultivator tilling the soil with a plough. Two healthy bulls are running with a yoke on their shoulders. The farmer himself, tying a *gāmchā* (handloom towel) round his head and wearing a short dress, is running behind holding the handle of the plough (Fig. 5).³⁶ Plough is mentioned in several copperplates of ancient Bengal. From 5th century CE to 13th century CE, among the systems for measuring land, one is 'hala'. For example, Dhulla Plate of Śricandra³⁷ and Bhatera copper plate of Govinda-keśavadeva³⁸ can be cited. In both these inscriptions the units of measuring land is 'Hala'. Even in recent past in the Varendra area people used to say, "*More tin Hāl jami āche*" (I have three hāl of land). The exact antiquity of the plough (*lāṅgal*) in Bengal is not known. But it may be possible to find out its antiquity by taking recourse to etymological analysis of the Bāṅglā words and their social explanation. For example:

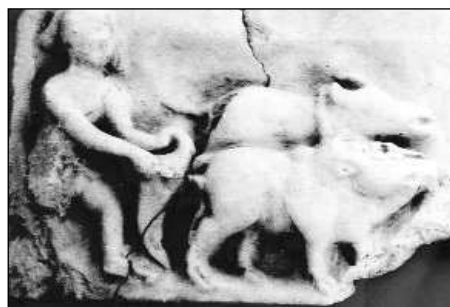


Fig. 5: Terracotta plaque depicting ploughing.

Lāṅgal (plough): In the dictionary of Bāṅglā language it is found that the word 'lāṅgal' has come from the Sanskrit word 'laṅga'. But analysing the etymology of the word 'laṅga' J. Przyluski has shown that the word 'laṅga' is neither an Indo-European nor an Indo-Aryan word. Rather he has proved that the word has come from Austric language,³⁹ and the word was taken into the Vedic language from the language of the people of pre-Vedic era; who are still tilling the soil with a tool similar to the male sex organ. Both *Liṅga* and *Lāṅgal* have come from the same root.⁴⁰

In Nepalese *Halo*, in Rajbangsi *Nāmgol*, in Boro language *Nāngol*, in Rava language *Lāngan*, in Garo language *Nāmgol*, in Dhimal language *Hale*, in Saontali language *Nahel*, in Tamil Language *navchil*, *avchil*; in Malayalan *Evagngol*, in Kannara language *Negal*, in Tulu Language *Nayeru*, in Toda language *Nekhel*, in Kuki language *Nangeli*, in Gondi language *Nangel*, in Noiki language *Namgar*, in Pengo language *nangel* is used as a synonym for *Lāṅgal*.⁴¹ All these languages are included in Austric, Dravidian and Bhut-Chinese language groups.

Hāl/Hala: is synonymous to plough in the Bangla language. In the Bangla language words like *halkarma*, *halabṛti*, *hāldeoā*, *hālbāoā*, *halacālan*, *haladaṇḍa*, *haladhara*, *hālī*, *halāgra*, *halya*, *hālīka*, *hāliya*, *halakarṣaṇ* are in use. Brahmanic God Balarām's weapon is *hala*. So, he is also known as *haladhara* or *halāyudha*.⁴² According to *Vyavahārik Bāṅglā Abhidhān* both *hal* and *hāl* originated from the Sanskrit root *hal*, but both of them are also included in the *Deśi Bāṅglā Śabder Abhidhān*.⁴³ Khudirām Das is of the opinion that the word *hāl*, the rudder of a boat, was incorporated into the Bāṅglā language without any change from the Saontali language of the Austric language group.⁴⁴ There is no difference in the meaning of holding 'hāl of a family', 'hāl of a boat' and 'hāl in tilling soil' in the Bāṅglā language. *Ache Garu nā bāy hāl /tār dukkha cirakāl* (Who has a cow but does not plough land, his sorrow will be permanent). Here *hāl*, in the sense of a plough, is also used as a word of Austric origin.⁴⁵

Based on these linguistic analyses of the words *Lāṅgal* and *Hāl/Hal* and from the presence of the words in many of the successor languages of the pre-Aryan Indian languages there is scope to determine that the word *Lāṅgal* has come from pre-Aryan Austric language. However, it does not give us any clear idea about the shape of the *Lāṅgal* in early time. It is also uncertain that at that time sticks or penis shaped hoes were not considered as plough.⁴⁶ In this regard the etymology of some words connected to the different parts of the plough can possibly help us.

Iṣ: is basically a stick made of bamboo or wood, which is connected to the main structure (*Gādā*) of the plough and used to drag the main structure of the plough. Its one side is comparatively narrow and there are some notches in the other side. According to Bāṅglā Dictionary the word *iṣ* has come from the Sanskrit word *iṣā*. In all probability the word entered into Sanskrit from Austric-Mundari language family, because the Saontali word *isi* means plough-beam to which the yoke is attached.⁴⁷

Cuḍā: The notches of *iṣ* are known as *āmrā* (or *āmdā*) in Rajshahi, Rangpur and Noagaon; in Chittagong it is known as *cuḍā*.⁴⁸ The notches are downward and centripetal. About the notches poet Mālādhār Basu wrote: *lāṅgaler iṣ yena danta sārī sārī*⁴⁹ (Fig. 6). Most probably the word *cuḍā* is a changed regional form of *cudhā*. In Dravidian and Austric language group *cuḍā* is used to indicate the round construction above the temple, the hair-locks on the head, ornament



Fig. 6: Plough.

for hair decoration etc.⁵⁰ The notch of *iṣa* known as *cuḍā* in Chittagong is also taken from the peak of the *iṣa* as an ornament.

Phāl and Pāśi: Phāl (coulter) is the only iron made part of the plough. Phāl is an attachment to the sharp upper part of the plough. To make this attachment stronger, a 'U' shaped hook is used. It is known as *Pāśi* in Noagaon. Even in the *Kṛṣiparāśara* phāl and pāśi are mentioned.⁵¹ In the *Śivasankirtan*, Śiva at the advice of his wife Gaurī, becomes a farmer and makes the *phāl* of his plough cutting the head of his own *triśūla*.⁵² It cannot be said definitely when the *phāl* was attached to the plough for the first time. But in *Manusmṛti* it is said that an iron coulter attached to the plough wounds the earth and creatures living under the earth.⁵³ Presumably *Manusmṛti* was written sometime between 2nd century BCE and 2nd century CE.⁵⁴ From this we are more or less certain that the history of attaching an iron coulter to the plough is approximately two thousand years old. In the Bāṅglā Dictionary etymologically the Sanskrit word *phāl* is indicated as the root of *phāl*. But Satyanarayana Das in his *Bāṅglāy Drāviḍ Śabda (Vyutpattikoṣa)* has mentioned that the word *pala* in Tamil, Malayalam, Kannaḍa and Goṇḍi languages of Dravidian language family, the word *palu* in Telegu, Kui and Malto languages and the word *palla* are synonymous to phāl.⁵⁵ So it seems that the word *phāl* has been assimilated into Sanskrit from the pre- Sanskrit Dravidian languages. Similarly there is the possibility of having affinity between the Santali word *pasi* or *phaosi* of the Austric language family and the *pāśi* or *phāl*. The meaning of *pasi* or *Phaosi* is snare by a noose or a kind of fastening a knot with rope.⁵⁶ It is to be noted that *pāśi* tightly attaches the *phāl* with the plough. Similarly, in day to day applied Bāṅglā language *khāter pāśi* connects the two sides of a *khāt* (bedstead). Among the list of utensils, weapons, ornaments, used by the Dravidian people, it is interesting to find stone plough-head.⁵⁷

Gādā: is the principal part of the main structure of the plough which is a triangular piece of wood. It is synonymous to the Santali word *gaudi*, which means *gadi*- a kind of soft cotton-filled quilt for sitting.⁵⁸ The part of the plough which is known as *gādā* also sits on the earth and from this point of view the main structure of the plough is known as *gādā*.

From the above discussion it can be said that there is no doubt that there is a connection between the pre-Aryan Austric-Dravidian language family and the words *iṣa*, *cuḍā*, *gādā*, *phāl* and *pāśi*. These words refer to the names of different parts of the plough and thus help us to study the history of the evolution of the plough. It has been said earlier that, according to linguists, the word *lāṅgal* is an Austric word and based on that Niharranjan Ray's conclusion was that the Aryans did not know agriculture and they learnt it from the pre-Aryan community. But Nazrul Islam, very pertinently raised a

question that though *lāṅgal* is a pre-Aryan word there is no certainty that the word *lāṅgal* meant the present-day plough. As the root of the words *liṅga*, *lāṅgal*, *lāg*, *ling*, *lāṭhi* is same, so this assumption (actually D.D. Kosambi's) that in the pre-Aryan period sticks, similar to the hoe, were in use in Bengal, not the fully-shaped plough. In this context the etymology of five words *īṣa*, *cuḍā*, *gādā*, *phāl* and *pāśi* can be considered. If the etymological explanation of the linguists about these five words is correct, it is not difficult to find a logical answer to Nazrul Islam's question. Because in a hoe like implement there is no need to attach an *īṣa* and in that *īṣa* there is no need for notches or *cuḍā*. Also, it is not possible to attach *gādā*, *phāl* and *pāśi* with it. So it is very logical to think that the plough got its proper shape in the pre-Aryan days. The Aryans were not the originator of the plough, rather before them the Austric-Dravidian community introduced plough-based agriculture.

Another problem should be solved if the above decision is taken regarding the antiquity of the plough. It needs to be confirmed that in the pre-Aryan period the use of iron prevailed in Bengal; otherwise the above-mentioned conclusion remains questionable. Firstly, it is generally an accepted fact in the history of Bengal that the Aryans introduced the use of iron. But recently fresh research by R. Pleiner has shown that till the second half of the first millennium BCE the Aryans could not make anything using iron.⁵⁹ Dilip Kumar Chakrabarti has also shown that in India iron made materials were in use before the coming of the Aryans to India. He has cited from different writings to show that approximately before 1200-1100 BCE the people of the western part of the Bhagirathi knew the technology of melting iron.⁶⁰ It is thought that from 4th century BCE to 4th century CE the Aryan influence spread in Bengal and it became stronger through the next two centuries.⁶¹ So the opinion that in the pre-Aryan culture there prevailed the use of iron in Bengal is not illogical.⁶² From these considerations it can be said that the Austric and Dravidians formed the population in pre-Aryan Bengal,⁶³ who knew the use of iron coulter in the plough. It is important to note here that very small amount of iron was used in the *phāl* of the plough.

Irrigation Technology

From the point of view of Bengal's geo-physical environment, it does not seem that irrigation will be necessary. Bengal's agriculture was always dependent on rain and there was no shortage of rainfall. But in spite of profuse rainfall, there were some necessity of irrigation. In the *Kṛṣiparāśara* mention has been made of rain based agriculture and the necessity of rain in agriculture has also been discussed with due importance. In this context, the desire for cloud and rain in

agriculture is nothing but the expression of the necessity of irrigation during draught or the absence of rain in due time. Outside Bengal,⁶⁴ in other regions of India, technologies for irrigation, such as *arahata*, *rahata*, *noria* or *araghatta* were being used.⁶⁵ But the farmers of Bengal, for ages, have used irrigation-technologies suitable for Bengal's geo-physical condition. Basically, that necessity of irrigation was met by using the surface water. But in some cases, there were arrangements to pull water from wells. Two irrigation experts, William Willcocks and Kapil Bhattacharya, have discussed about the irrigation system of Bengal. In their theoretical discussion, there are contradictions. Without entering into the details of the contradictions, it would be reasonable to try to find out the different irrigational implements, which were in use in Bengal at the peasants' level and their antiquity.

Irrigation means artificial management, especially in dry season, of supplying surface or underground water to the cultivable lands for producing crops. The level of water can be higher or lower than the level of the crop-land. In all these circumstances, the system of irrigation will be different, the implements and technology will also be different. Among the different ancient irrigational implements *Don*, *Ḍāb* or *Duph* (bucket/vessel), *Uri* (bailing vessel) and *seuty* (bailing vessel) seems to be very common.

Don is a manually driven and lever based irrigation device, which is known by different names in different regions. The other names of it are *Doṅgā*, *Duni*, *Kundā*, *Kon* etc. In the Bangla Academy Dictionary *Don* and *donga* have been translated as the pot for water withdrawals. But in the same Dictionary *Duni* is described as device used to lift water from river or pond. Again in the Dhaka area the trunk of a Palm tree is used for lifting water and is called a *Don*. *Don* is almost like a boat. Probably in the past the curved outer slough of the palm tree was used as *Don*. From time immemorial the curved outer slough of the

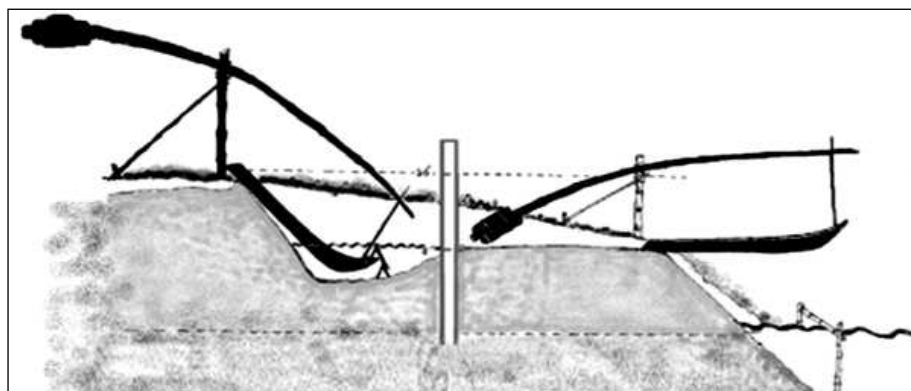


Fig. 7: Traditional technique of water lifting in two steps.

trunk of a palm tree was used as a boat in Bangladesh.⁶⁶ From very early period palm trees were available in plenty in Bengal.⁶⁷ Later *Dons* were made from the trunk of tall trees (Pl. 4).⁶⁸ Usually the '*don*' is 13-15 feet long.⁶⁹ In the beginning of the 20th century⁷⁰ when the use of tin came to Bengal, making of '*don*' become easy by using tin sheets.

With the *don* surface water can be lifted up to a height of about 7 feet; but it is very effective up to 3 to 5 feet. A *Don* can lift 177-378 liters of water per minute.⁷¹ Using *Don* water can be lifted to a much higher level step by step (Fig. 7). In every step water can be lifted up to 3-7 feet. Bengal abounds with rivers, canals, *bils*, ponds etc. It can be said that the *don* was very effective in watering the agricultural fields.

Ḍāb (Bucket or Vessel):⁷² Like *Don*, *Ḍāb* is also a manually driven and lever based irrigation device (Pl. 5), which almost looks like a sliced *Ḍāb* (green coconut). A closely related word used in Rajshahi is *Ḍābkua*, which refers to a water lifting tool made of cane. *Ḍuri* is a huge *Sewti* in Barisal. In some region, a bucket used for pulling up water from a well is known as *Ḍol*.⁷³ But the main characteristic of *Ḍāb* is that it can pull up underground water. So, *Ḍāb* has a close relationship with a well. Such type of irrigation device was used in the agriculture of Egypt in 14th century BCE (Fig. 8).⁷⁴ The Irrigation Museum has prepared a time log of the invention and use of irrigation devices and according to this the use of *Ḍāb* technology dates back to the 17th century BCE.⁷⁵ Probably in ancient Bengal a kind of pot having handle made of wood, bamboo or cane, especially bucket shaped pots were used as *Ḍāb* or *Dhuf*. Wood, bamboo and cane were available in Bengal. Later *Ḍāb* was made of tin-sheet. Its working process is similar to *Don*. Comparatively the rate of water lifting capacity of *Ḍāb* is lower than *Don*. But where the bank is straight *Don* or *Sewti* cannot lift water and at that time by digging a well, water can easily be lifted by a *Ḍāb*. By using a *Ḍāb* water can be lifted up from a depth of 8 to 9 feet.⁷⁶

Sewti (Bailing vessel): *Sewti* is a simple irrigation device, the shape of which is like a basket or a shovel (Fig. 9). It is mentioned in the *Caryāpada*.⁷⁷ Based on its use it can also be called a swinging basket.⁷⁸ In

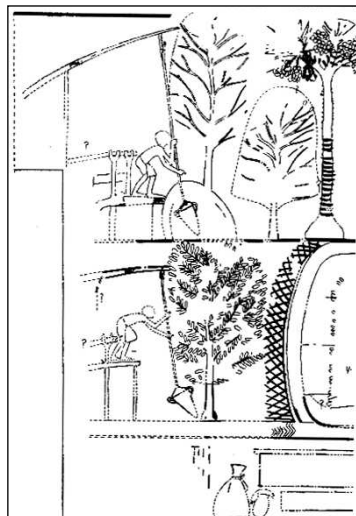


Fig. 8: Drawing of *Shaduf* (irrigation tool) used in ancient Egypt, after Norman De Garis Davies.

Fig. 9: *Sewti*.

the past cane or a coarse mat made of bamboo slips was used for making *sewti* (Pl. 6). Two men, standing face to face, holding the rope connected to the *sewti*, used to swing the *Sewti* for lifting water (Pl. 7). *Sewti* was generally used for lifting surface water. Using *Sewti* water could be lifted up from a depth of 4 to 5 feet. If the source was within 3 feet, about 227 liters⁷⁹ of water can be lifted up in a minute

Uri is also a kind of *Sewti*; its materials, making method and shape are similar to *sewti*. But its method of use is different. Instead of two, one man, holding the handle in one hand and the rope in another hand, lift up water using it as a *sewti*. A *Uri* can lift up less water than a *sewti*. But it is a simple irrigation device and for using it no extra arrangement is needed.

Irrigation technology had the following characteristics: ability of lifting up surface and underground water and the capacity of reaching the flow of water to the high crop lands. Ancient irrigation devices and technologies were consistent with and suitable for Bengal's geo-physical environment. *Don*, *Sewti*, *Uri* etc. were quite effective for lifting surface water to different heights.

We do not have any evidence to prove the antiquity of these ancient irrigation devices. But to prove the antiquity of the irrigation-devices we may take recourse to literary sources and etymology of the words:

Don: Other names of *Don* are *Doṅgā*, *Duni*, *Kuṇḍa*, *Kon* etc. Among these names *Doṅgā*, *Duni*, *Don*, *Droni* are in use in Bāṅglā language and it is easily perceived that their source is the same. According to Bangla Academy's Dictionary and Kshudiram Das, *Doṅgā* is an Austric-mundary or Saontali word. It may be mentioned that the word *Doṅgā* bears the meaning of *Diṅgi boat* as well. Because *Doṅgā* which was made by digging the trunk of a palm tree, was used both as an irrigation device and as a boat.

Ḍāb: Green coconut is known as *ḍāb* in Bangla language. *Ḍābar*, in medieval Bengal, was a wide open-mouthed pot. In the Bangla language, words nearer to them are *Ḍub*, *Ḍubā*, *Ḍobā*, *Ḍābu* and *Ḍol*. The meaning of *Ḍub* is immersed in water or bathing by immersing one's body in water in a pond or river. Even today in the Varendra area *Ḍub* has the same meaning.

Ḍubā and *Ḍobā*, have two different meanings at the same time. The words are used to refer to a small water body or canal full of water. *Ḍābu* means a round pot with handle and *Ḍol* means a round shaped container made of bamboo. In Varendra region the shape of irrigation-device *Ḍab* is similar to a green coconut when it is cut in the middle. That is similar to *Ḍabur* of the medieval Bangla language. Considering these it can be said that there is inter-relationship among all these words. *Ḍābu* is an Austric Saontali word. Suffixing the Bangla word *Ur* with *Ḍāb* came *Ḍābur*. Apart from these, Austric Saontali words *Ḍābrā*, *Ḍābā*, *Ḍubu*, *Ḍābādubu* etc. refer to bathing in a pond jumping in the water. Moreover, *Ḍob* means bucket in Barisal; it means pond in Pabna, *Ḍāb* means irrigation device made of cane in Rajshahi and *Ḍābkua* means a kind of earthen-well; *Ḍuri* means *Sewti* in Barisal. From these information, it can be said that irrigation device *Ḍāb* is closely related to the Austric community who established their habitation in Bengal in the remote past.

Sewti: In many literary works of medieval Bengal *Sewti* is found as an irrigational device, meaning bailing vessel.⁸⁰ *Sewti*, *Seuni*, *Secanī* are closely related to irrigation. *Sewti* and *Sec* - these two words originated from the Sanskrit words *Secanī* and *Sich*. In Mymensingh's local language *Sewti* is pronounced as *Uci* and *Ucā*. In *Ancalik Bhāṣār Abhidhān*, the shape of *Sewti* is mentioned as triangular and it was made of bamboo. The process in which *Sewti* or *Uci/Uca* is used in irrigation, is similar to the use of the Austric word *Uc*. In Santali language *Uc* means jumping.

Apart from these there are some words in the Bāṅglā language, which mean various types of irrigation devices made of wood, bamboo or cane. For example, *Cheni* in Rajshahi means a kind of water lifting tool. In Sylhet, a kind of water lifting device is called *Kundakorā* and another irrigation tool made of wood is known as *kuin*. In Mymensingh the word *kundā* means a boat made from the trunk of the palm tree. Another word *nālā* means a channel for draining out water. This word has come in an unchanged form into Bangla language from the Austric-Saontali language.

Seed Collection and Preservation Technology

Agriculture would not have spread without the invention of the techniques for the preservation of grain-seeds. But, all grains are not seeds. Only those grains are considered as seeds which are preserved for the next season. The main purpose of preservation is to protect the healthy seeds capable of germination till the next season. The process which is used to preserve the seeds in a specified humidity and protect them from fungus, insects and rats is known as

the seed collection and preservation technology. The experience of the farmers of Bengal and their knowledge have been used in this seed selection and preservation process for ages.⁸¹

Collecting information from the Rangpur, Dinajpur, Naogaon, Kusthia, Jinaidah, Jessore, Khulna, Mymensingh, Kishoregonj and Sylhet districts of Bangladesh it has been seen that in all the places the same technology is used for the preservation of seeds. Farmers at first select the best plants of his field. In the case of crops like rice, wheat, barley, mustard, coriander etc. the plants should be harvested after the grains become mature. Initially all crops should be harvested leaving the selected plant on the field. Then the selected crops for seeds are thrashed separately and it is done so delicately that only the healthy grains fall off. Among the other crops like Jute, Radish, Garlic, Onion, Pepper, Chili, *Karallā* (bitter gourd/Mormonica cheranlia), Beans, Okra, various Potherbs, farmers must wait longer than usual to collect their seeds. Potato, Ginger, Turmeric plants are left till their death in the field. Then the seeds are husked using a *Kulā*. After that the weed-seeds are removed by hand. Then the selected seeds are spread out in the sun to dry. At the time of drying the moisture is checked by biting a few seeds. After checking the moisture those seeds are taken away from the sun and preserved as seeds for cultivation in the next season.⁸²

At the first stage of preservation, container has to be selected according to the amount of seed to be preserved. Seeds are preserved in different types of pots or jars, which should be dry. After filling up the container with seeds, which are cooled down after being sun-dried. The opening of the container is then sealed with a lid and mud-plaster, so that air cannot enter. If the container is not fully filled up, the remaining portion is filled up with straw, chaff, bran etc. As an extra precaution sometimes powder of the leaves of *Biskatal* (Belladonna) *Neem* (Margossa) and tobacco are mixed with the seeds. In case of a terracotta jar, its outside is coated with mud or *gāb* (fruit of *Diospyros embryopieris*) or tar. If seeds are preserved in this way there is no need to dry them again under the sun. Types of pots which are used for preserving seeds in different regions are:

Auḍi: *Auḍ* means straw or bundle of straw.⁸³ and *Auḍi* means a kind of container made of bamboo for preserving paddy in greater Jessore, Rajshahi, Faridpur (Pl. 8).⁸⁴ Farmers themselves make it using bamboo, mud, dung, bran and straw. It looks like a barrel or an orange. Besides crops, seeds are also preserved in *Auḍi*; in that case the upper and lower vents are sealed with lid and mud. It seems that *auḍi* has some connection with the Austic-Saontali *āḍāc* and

the Dravidian word *āḍā*. *Āḍāc* means the upper part of a platform made of wood or bamboo;⁸⁵ while *āḍā* means an elevated place for stacking straw.⁸⁶

Kalasa: It is an earthen pitcher, which is usually used to store water. But it is also used to preserve various kinds of seeds throughout the whole of Bengal. After putting seeds inside, its top is sealed with a lid and mud.

Kūṭi or kuṭhi: In the Dictionary its meaning is given as round pot and used in greater Rajshahi and Dinajpur.⁸⁷ But *Kūṭi* or *kuṭhi* is not burnt, but raw, and it is made of straw and mud. Its shape can be round, oval or square (Fig. 10).⁸⁸ In Godagari of Rajshahi a *Kuṭhi* was measured, the circumference of which is



Fig. 10: Different variety of *Kuṭi/Kuṭhi*.

17 feet, height 6.5 feet and thickness is 4 inches.⁸⁹ In those *Kuṭhis* rice, paddy and other grains are preserved. The grains inside it is totally safe from pests and insects. These words are nearer to the Dravidian word *kadui* and *kudsi*, which mean storage for paddy (*golā*) or round shaped storage made of straw for paddy. Synonymous Tamil words are *kuluke* or *kuḍuke*. Kanarese word *keḍike* means a basket for keeping grains. It may be mentioned that both Tamil and Kanarese are in the Dravidian language group.

Kolā: In Kusthia-Jinaidah in Bangladesh, *Kolā* is known as a big earthen pot (Pl. 9). Different types of grains and paddy are preserved in a *Kolā*. Seeds are kept inside the *Kolā* and its vents are sealed with lid and mud.

Golā: It is a granary where paddy is preserved.⁹⁰ Besides words like *Golāghar*, *Golābāri*, *Golājāt* etc are connected with the preservation of crops. In the open yard of outer and inner side of the house *Golā* is made. Generally, it is made of bamboo and straw. In Rajshahi there are two types of *Golā*: one is a separate structure and it can preserve about hundred maunds of grains (Fig. 11). Another type of *Golā* is small in size and similar to *Kuṭhi*. Large *Golās* are similar to the *Auḍi*. In the large *Golā* grains are preserved, while small *Golās* are used to

preserve seeds. From the shape of the *Golā*, it appears that the word originated from the word *Gol*. The Austric-Saontali word *Gul* means round shaped object⁹¹ In the northern and southern parts of Bangladesh even today *gol* is pronounced as *gul*.

Jālā: It is a kind of earthen pot with a bulging middle part,⁹² very suitable for preserving seeds.

Ḍābar: It is a kind of a pitcher for keeping water.⁹³ But it is used for keeping rice in greater Rangpur, Rajshahi and Mymensingh area.⁹⁴ To preserve seeds *Ḍābar* is an ideal pot, and it is made by a potter. *Ḍab*, *Ḍābar*, *Ḍol*, etc. are Austric in origin. Saontali word *Ḍabrā* or *Ḍābā* means big earthen pot or jar.⁹⁵

Ḍol/Ḍuli (Grain-bin): It is a kind of huge container made of thin slip of bamboo, reed or bulrush (a kind of aquatic grass for making walls of huts), and it is suitable for keeping rice, paddy etc.⁹⁶ In Naogaon of North Bengal *Ḍol* is used both for preserving grains and keeping soaked paddy before boiling. Before keeping grains in a '*Ḍol*' it is coated with mud. Then after keeping crop seeds inside, its top is sealed with straw, bran and ashes etc so that the seeds are not spoiled. *Ḍuli* refers to *Dhāner Golā* in Comilla, Dinajpur, and Jessore. In Comilla '*Ḍuli*' is also known as *Ḍul*. In Sylhet *Ḍulā* means basket of paddy.⁹⁷ In medieval literature the word *Ḍuli* was used as a container made of bamboo.⁹⁸

Bhār: is a kind of small pitcher. The word *Bhār* is also known as *Bhārār*, *Bhāndār* etc. where wealth or food or something else is preserved.⁹⁹ *Bhāra* or *Bhānda* is *Kalasa* shaped terracotta jar .

Maṭkā or Maṭki: is a large earthen cask used to preserve paddy, like a *Ḍābur*.¹⁰⁰ But in Barisal *Maṭki* refers to a fat round and narrow mouthed container made of bamboo.¹⁰¹ In Naogaon area large pitcher made of clay is also known as *Maṭki*. The Tamil word *Maṭakka*, Malto word *Met* are synonymous to *Maṭkā*.¹⁰² The Austric word *Moṭkā* means fat but short, wealthy, an aged person.¹⁰³

Marāi: It is a kind of storage (*Golā*) for paddy.¹⁰⁴ In the medieval period this word was used to refer to a kind of storage for paddy, made of *Hoglā* (sort of



Fig. 11: *Golā*. [Courtesy: Sajib Ahmed].

mat made of a kind of aquatic grass) or cane.¹⁰⁵ *Golā* is known as *Marāi* in the Rāḍha region. The system of making *Marāi* is a bit different; around a platform, made of bamboo and straw, bundles of straw are spread out to create a space in which paddy seeds are kept in the middle and then the straws are bundled and tied with a rope made of straw (Pl. 10). When the tying and keeping crop seeds are finished, a layer of straw is spread over it.¹⁰⁶ The word *Marāi* possibly derived from the Austric Saontali word *Murāi*, which means granary or *śasya bhāṇḍār*.¹⁰⁷

***Mocā*:** It is a kind of temporary pot made with straw to keep paddy seed, and it is common in greater Dhaka and Noakhali area.¹⁰⁸ In Comilla, rope is used to make it with straw. At first ropes are spread out from a centre. On the spread out ropes a few inches of thick layer of soft and dry straw are placed. Then paddy seeds are kept on the layer of straw, and the layer of straw is wrapped up slowly from all sides and at last tightly tied with the ropes which were initially spread out. In this way *Mocā* is made, and in a large *Mocā* about 40kg paddy seeds can be preserved.¹⁰⁹ In Barisal region banana leaf or *Hoglā* (a kind of aquatic grass) leaf is used with straw to make a *Mocā*.

***Myāṭā*:** In the Rajshahi region earthen small *Dābor* is known as *Myāṭā*.¹¹⁰ Tamil word *maṭā* or *miṭā* means a big earthen vessel. The Mālto word *miṭābu* means a big water jar, *mirābu* stands for a big vessel; Kannarese word *madke* or *madike* means a vessel, Tulu word *madke* means an earthen vessel for keeping local wine (*tāḍi*); Kui word *maṭ* means a vessel; Telegu word *maukudu* means an earthen vessel or plate.¹¹¹

***Hāṇḍā* or *Hāṇḍi*:** It is a big earthen pot. In Birampur of Dinajpur large earthen pot is known as *Hāṇḍā*. In these pots crop-seeds are preserved. The Austric Saontali word *Hāṇḍi* means a kind of liquor distilled from rice and in the distillation process *Hāṇḍās* are used. The word *Hāṇḍā* is an Austric Saontali word meaning a big earthen vessel.¹¹²

From the above discussion it seems that the people of Bengal used pots of different kind to preserve grains and seeds. The names of the pots that have come up in our discussion are: *Kalasa*, *Kolā*, *Dābar*, *Maṭkā* or *Maṭki*, *Bhāḍa*, *Myāṭā*, *Hāṇḍā* or *Hāṇḍi* and *Hāḍi*. All these vessels were made by potters and they were baked. These earthen pots were of different shape and had different regional names. The multifarious use of all these vessels is noticeable in village life. On the other hand *Auri*, *Kuṭhi* or *kuṭi* and *Golā* were made of mud, straw and bamboo. All these were made to preserve grains and seeds. *Dol* or *Duli* was also made of bamboo sheet and was mainly used to preserve seeds, but it had other uses also. On the other hand, *Mocā* and *Marai* were made solely to preserve crops and seeds and these could not be reused.

Many types of earthen pots have been discovered from Wari-Bateshwar, Mahasthan, Paharpur, Govinda Bhita, Bhasu Vihara, Raja Harish Chandra's Bari and Salvan Vihara of Bangladesh and from Pandu Rajar Dhibi, Mahisdal, Bangarh, Tamluk, Chandraketurah, Mangalkot, Bharatpur, Rajbari Danga etc of West Bengal. The earthen materials found in different archeological sites, have been dated approximately between 1500 BCE to 300 BCE.¹¹³ In this regard we may refer to some finds of pots for preservation, discovered from Mahasthangarh, Paharpur, Mainamati and Itakhola Mura.¹¹⁴ These earthen materials prove the antiquity of the system of preservation of grains and seeds in early Bengal.

Rice Production Technology

Basically there are two types of rice: *Atap rice* (Sun-dried rice) and par-boiled rice. For producing *Atap rice* paddy is dried well under the sun and then husked. In some parts of the country *Atap rice* is eaten, but basically this *rice* is used to make *Piṭhā* (indigenous cakes) and *pāyes* (rice pudding) etc. To produce par-boiled rice, paddy is first soaked in water and then that soaked paddy is boiled in a pot. Boiled paddy is then dried under the sun and then husked. Generally the process of separating the outer covering of the paddy is known as husking. In many regions husking is known as *Dhān koṭā*, *Dhān kuḍā*, *Bārā bhānā*, etc.¹¹⁵ Before the 19th century no motor-driven device was used for husking paddy; before that husking was performed using traditional technology.¹¹⁶

Traditional Indigenous Husking Technology: In Bangladesh the culture of husking is intimately related to life and very effective. Among the indigenous technologies of husking the most common is the use of *Dheki* (husking pedal). Besides *Dheki* the other tools are *Udukhal* (Mortar), *Jātā* and *śil-pāṭā*.

Dhenki: *Dhenki* is a lever based complex rice husking machine driven by leg. In almost all the regions of Bengal it is known as *Dhenki*. It is made with a combination of five parts. The main part is actually a trunk of a tree that is used as a liver stand. A round wooden pounder is attached to its front side. Wakil Ahmed has named it *Mudgar*. In the lower part of the *Mudgar* a thin ring of iron is attached. This is the only iron element that is used in a *Dhenki*. Wakil Ahmed has named it *Śāmā* and its two regional names are *Mohanā* (Rajshahi) and *Gu'ilā* (Tangail).¹¹⁷ In Pabna it is *Gule*, in Jessore it is *Gulo* and in Naogaon and Bhola it is known as *Gulā*. Basically the *Śāmā* of a *Dhenki* works as its hammer.

The opposite part of the *Dhenki* is attached to the back side of the lever. It is also round shaped wooden stick—expanded in two sides. Wakil Ahmed named this part *Komarśalākā*.

One of the two individual parts of a *Dheki* is *Gar*. It is directly placed on the ground. Wooden *Gar* is a chopped tree-trunk, in the middle of which there is a shallow hole. The other individual part is *Poyā or Puyā*. It is basically two notched wooden stand. These stands are driven deep into the ground. In Jessore and Bhola *Poyā or Puyā* is made from the upper part of tree-trunk. In both cases *Komarśalākā* of the *dheki* is placed in the notch of the stand.

A *Kulā* (a light winnowing platter or tray) is needed for husking paddy by *Dheki*. To operate a *Dheki* minimum three persons are needed. Two persons run the *Dheki* with their legs and that, in our society, is known as *Dhekite pā deoa* and one person turn over the paddy in the *Gar*; separate rice from the husk and gives new paddy in the *Gar*. The regional name of these works (in Naogaon) is *Aledeoya*, and the person who does it is known as *Ālānī*.

Udukhal (Mortar): *Udukhal* is another traditional husking machine. Its use is still seen in hilly areas of Sylhet and Rangpur. It is made of wood and looks like a *Dugdugi*. It is also known as *Chyāoyā, Okhali, Ukali, Ukhali* etc. It has two parts; the main part is known as *Chyāoyā* or *Okhali* and the other part is known as *Muśal* (Pestle). *Muśal* is basically similar to the *Mudgar* of *Dheki*, but it is longer than that. In one part of *Muśal*, the *Śāmā* is attached like the *Mudgar*. One or two persons operate the *Muśal* and thump the rice in the *Udkhal*.

Jāntā: It is actually a device made with two pieces of round stone plates used for grinding grains etc. Grains are placed in between the two stone plates and then by revolving the upper stone the grains are husked.

Śil-noḍā: *Śil* is basically a rectangular, thick and flat piece of stone and its other part is *noḍā*, which is a cylinder shaped piece of stone. Putting turmeric, chilly and other spices on the *Sil-pāṭā, Noḍā* (the pestle) is rubbed back and forth for grinding the spices. May be in earlier times it was used for grinding corns or different kinds of pigeon-peas (*ḍāl*).

Antiquity of the Traditional Husking Devices: There is no evidence to prove the antiquity of the husking devices. Except a terracotta plaque found in West Bengal, no archeological object of the ancient period has so far been discovered. Only literary sources can help us. Important information can be collected from etymological analysis of the names of the devices, including their parts.

In the *Śunya Purāṇa* there is a chapter (28th) titled *Atha Dheki-maṅgala*.¹¹⁸ Apart from this almost all medieval writers have referred to *Dheki*.¹¹⁹ In *Sadukti-Karṇāmṛta* compiled by Śrīdhara Das there is a poem

which says, singing song village women are husking paddy and with their songs is mixing the sound of their dangling bracelets.¹²⁰ In one of the terracotta plaques decorating the Damodar Navaratna temple (built in 1786) at Kalyanpur, Howrah (West Bengal) there is the depiction of two ladies husking paddy in a 'dheki' and another lady is assisting them by acting as an 'ale'.¹²¹ Like *Dhenki*, *Jāntā* was used to separate the husk from grain. The medieval Bangla literature bear evidence of the use of *Jāntā* for husking paddy.¹²² Probably the word *Jāntā* first appeared in the *Śūnya Purāṇa*.¹²³

It has been said earlier that there is no definite source to prove the antiquity of the different technology used for husking paddy. But the Baigram copper plate of Kumāragupta I (447-48 CE), found in Hili area of Dinajpur district of Bangladesh, mentioned that burnt husk of grains was used for demarcating the boundary of cultivable land.¹²⁴ From this it is evident that the system of separating husk from paddy was in vogue in Bengal from very early time. This can be further corroborated by analysing the origin of words related to paddy husking. In linguistic discussions in the dictionaries *Dhenki* or *Dhenki* is mentioned to be of Mundāri or Mundāri-Austrian origin.¹²⁵ In Hindi the word is *Dhenki*,¹²⁶ in Nepalese it is *Ḍhiki*, in Rājbaṅgī, Sādri and Toto it is *Ḍheki*, in Boḍo Language it is *Ḍikhi*, in Rābhā language it is *Ḍhiñki*, in Gāro language it is *Dheñki*, in Dhimal language it is *Dheñki*, in Kuduk language it is *Ḍhiñki*.¹²⁷ Among these languages Boḍo, Rābhā, Gāro, Toto and Dhimal are from Bhot-Brahmo language family and Kuduk from Dravidian language group.¹²⁸

After grinding paddy we get *cāul* (rice). The word *cāul* entered the Bāṅglā language from the mundāri word *cāole*.¹²⁹ In Bāṅglā *dhānbhānā* is often referred as *kāḍā*, *kuṭā* or *koṭā*. All these words originated from Dravidian source.¹³⁰ During *cāulkāḍhā*, (paddy grinding) *Āleni* does the work of *Āledeyā* (the work of putting the rice into the grinding hole). *Āle* used in these two words comes from Sānotāli word *ulāo* and used to mean the same.¹³¹ The first step of *dhānkāḍhā* (paddy grinding) is known as *bānkāḍh* in Rajshahi and Dinajpur area. This word may have had a close connection with the Dravidian word *ākḍhā*, which means paddy without grain or *tuṣ* (grain-husk). Sometimes *tuṣ* is known as *bhūṣi* and in Faridpur area any skin of grain is known as *salā*. Among these two, *salā* originated from Sāontāli without any change and *bhūṣi* is from *bhūṣou* of Sāontāli language.¹³²

Kulā (winnowing fan made of bamboo slips) is used to separate *cāul* and *tuṣ* during *dhānvānā*. The word *kulā* entered Bāṅglā language from the Sanskrit word *kulya*. But in the Dravidian language *kulā* is used, bearing the same

meaning. ‘*Kulā diye dhān bā cāul jhārā*’, the word *Jhārā* used in this sentence express the same meaning in Austric and Dravidian language groups. The pot for keeping rice is known as *jhuri*, *tukri* or *ḍālā*. All these three words are from Sāontali of Austric language groups.

In grinding rice *Mudgar* of the *Dhenki* and *Muśal* of the *Ukhli* play the same role. *Mudgar* means *Mugur* or *Gadā* (mace). The word is the composite form of Sanskrit *Mud+gar*. On the other hand *gadā* is connected with Dravidian language with the same meaning.¹³³ *Muśal* is also of Dravidian origin. *Śāmā* or *sāmā*, meaning iron ring in the top of *mudgar* or *muśal*, originated from the Saontali word *Śāmbhe*. Its local variations- *chyā* or *chyāoyā* probably originated from *sāmbhe*. *Gadh* is an important part of *dhenki*. *Gadh* is a sāontali or kola-muṇḍā word, which entered the Bāṅglā language without any change.¹³⁴ Krishnapada Goswami took *gadh* as a indigenous word meaning a ‘small fort surrounded by deep canals’.¹³⁵

In Bāṅglā language the word *gādhā* means *garta* (hole), *khānā* means a ditch, or *dobā* means a ditch filled with water. In the Varendra region the word *gādhā* means container made of bamboo for keeping cattle foods produced from *khadh* (hey) or *bicāli* (the dry stalk of paddy). The word *Gadh* means a small fort, *Gādhā* means a *dobā* and also container of *bicāli* – all the words have a common feature that these are more or less of round shape. Same is the shape of the *gadh* of the *dheki*. The words *Gārā*, *Gāḍā* or *Gaḍ* are of Dravidian origin.¹³⁶ *Gadh* of a *dheki* is also similar in shape. The local variation of the word *gaḍ* is *pāran*, *pāron* or *pāḍan*. In *Byabahārik Bāṅglā Abhidhān* all these words are mentioned to have originated from the Sanskrit root *pāt*. In another source it is mentioned that the word came into Bāṅglā from Sāontali.¹³⁷ The word *udūkhūl* belongs to the Dravidian group of languages.¹³⁸ But in Bengali dictionaries the word is considered as a Sanskrit word (Ut+ukha+la).¹³⁹ In Sāontali language the word *ukhūḍh* means a wooden container on which paddy is ground to bring out rice.¹⁴⁰

The local words for *Komarśalākā* (main twig) of *Dheki* are *Āḍśali*, *Āḍhalui*, *Āḍāl*. These words are of Sāontali origin, derived from *auḍis* and *auḍic*, which mean enmity. Probably the Bāṅglā word *Āḍā-Āḍi* originated from this word.¹⁴¹ However, *Komar salākā* is used in *Āḍha-Āḍhi* (angular) position in *dheki*. The words *śil-pāṭā* are mentioned in the dictionary to have originated from Sanskrit. But others thought them to be pre-Aryan words.¹⁴² Such as *ḍāl*, *maṭar*, *kalāi*, *cholā*, *khosā*, *Gujā* or *Guji* etc. are of Austric or Dravidian origin.

Oil Extraction Technology

There is no doubt that in Bengal and India, traditional technology was used to extract oil from oil-seeds.¹⁴³ The traditional device for extraction of oil from seeds is known as *Ghāni*. Now a days the use of *Ghāni* is rare in Bengal.

Ghāni is a complex oil mill made of wood and driven by animal power. In its middle there is a cylindrical structure with a hole. Oil-seeds are put in the hole, where they are smashed to extract oil (Fig. 12). The *Ghāni* is divided into three parts. The main part is *gāch* or *ghānigāch*, a tree trunk. About half of the trunk is sunk in the earth.¹⁴⁴ In the middle of the upper part a short and hollow tube is attached to it. In the lower part there is a narrow hole,



Fig. 12: *Ghāni*.

which spreads to the outer side of the wooden shaft. This hole is known as *rasanālī* in Jessore area of Bangladesh. A *pātani*,¹⁴⁵ tongue shaped dripper, is attached to the outer side of the hole (Pl. 11). Probably this *pātani* is known as *jihbā* (tongue) in Dinajpur. It is made from a small sheet of tin or a small piece of bamboo. On the top the *gāch* a wooden-ring is attached. It is known as *dālā* and *khol* in Dinajpur, or *oḍā* in Jessore. Generally this ring is made from the trunk of palm tree. The ring is made by removing the soft part from the middle of one foot long palm tree's trunk.

The second part of the *Ghāni* is *Jāit*, *Jāt* or *Jāṭh* (Pl. 12d). It is a kind of wooden roller. *Jait* grinds the oil seeds that are put in the hollow of the *gāch*.

The third part of *Ghāni* is *Kātāri*¹⁴⁶ or *kāntār*, which is a plank of wood (Pl. 12a) and with its help the *jāit* revolves inside the cone shaped hollow and grind the oil seeds. Approximately in the middle of *katari* there is hole, in which a wooden bar is attached angularly. In Jessore this wooden bar is known as *matam* or *matam-kāṣṭha* (Pl. 12b). Then a *māhaḍi*¹⁴⁷ is placed at the top of the *Jāit* and the *Matom-Kāṣṭha* is tied with the *Mahḍi* by a rope or *hyāḍe*. In Dinajpur the *Mahaḍi* is known as *Dogi* and in Jessore *Makaḍi*. *Mahaḍi* or *Dogi* is actually a handle made of wood and shaped like a spoon (Pl. 12c). As *Mahaḍi* and *Kātāri* are linked, a part of the *Kātāri* is directly connected to the *Ghānigāch*. On the other part a weight of about 1.5 to 2 mounds is placed.¹⁴⁸ Sitting on this weight a man operate the *Ghāni*.

We have mentioned earlier that the *Ghāni* is driven by cattle. For this one part of the yoke is attached with *Jāit* and the other part is attached with the shoulder of the animal. At the time of ploughing, an *Īṣ* is attached to the yoke and similarly to revolve the *Jāit* a rope is tied between the *Kātāri* and the yoke. When the animal revolves round with the yoke, the *Kātāri* too revolves. And with the *Kātāri* revolves the *Jāit*. Since weight is put on one side of the *Kātāri*, the *Jāit* grinds the oil-seed put inside the cone shaped hollow space. The half-ground seeds are turned around several times inside the hollow space. Oil comes out through the drip-pipe and the left-over (called *khail*) are used as cattle food.

It is difficult to prove the antiquity of the *Ghāni* as an oil extracting device. Not a single archeological remain of it has yet been discovered. Literary sources may be of some help. Besides, important information can be found from the etymological and linguistic explanation of *Ghāni* and *Ghāni* related words.

One who produces oil using *Ghāni* is known in the Bāṅglā language as *kalu*, *telī*, *tilī*, *tailika*, *taili* etc. In *Caṇḍimaṅgala* it is mentioned: *Teli bāise kata janā, keha cāṣi, keha ghanya, Kiniñā becaye keha tel.*¹⁴⁹ (A few *Teli* sit (in the market), some are cultivators, some are *ghanya*, Some buy and then sell oil). Selling of oil in *hut* (market place) is also referred to in that source.¹⁵⁰

In *Caṇḍimaṅgal* we find references to the *Kalu*, *Ghanya* or *Teli* who produced oil and sold it roaming in the village and *hāṭ* (market). That the *telis* had established *Ghāni* in the cities too is mentioned in the *Caṇḍimaṅgal*. But earlier Caṇḍidāsa (14th century) in his *Śrīkrṣṇakīrtan* writes: *Tailakār Patni* (oil producer's wife) goes outside the house; *telinī* (wife of the oil producer) is going to sell oil and the *telī* is going ahead taking the oil jar on his shoulder.¹⁵¹ Images of production and selling of oil described in *Śrīkrṣṇakīrtan*

and *Caṇḍimaṅgal* confirmed the use of *Ghāni* in oil production in Medieval Bengal. For the earlier period we have to take recourse to etymological and linguistic analysis.

Ghāni: According to dictionary the meaning of *Ghāni* is a kind of oil machine driven by animal. The word *Ghāni* is Austric-Saontali.¹⁵² But there are some scholars who consider that the word *Ghāni* has evolved from the Sanskrit word *ghrāṇikā*.¹⁵³ Though in the Bangla Academy Dictionary the meaning of the word *Ghāni* is the same, but its root is presented as the Sanskrit word *ghana*.¹⁵⁴ Whatever is the root of the word *Ghāni*, it proves the antiquity of the use of the word. But in most of the other languages, like Kodagu, Malayalam, Tamil and Kannara, the word *Ghāni* has been accepted in an unchanged form. These languages are included in Dravidian language family.¹⁵⁵ So it is logical to think that the word *Ghāni* was present in the pre-Aryan period.

Kolu: In the Bāṅglā language the word *kolu* is variously pronounced- *kulu* or *khulu*. Etymologically the word is Saontali word *kulhu*, which means the person who produces oil using *Ghāni* and sells it.¹⁵⁶ But many scholars think that the word *kolu* has come from the Dravidian language.¹⁵⁷ Considering these, it is fair to think that the word is indigenous,¹⁵⁸ though in the Bangla Academy's dictionary *kolu* is presented as a Sanskrit word.

Khol, Ḍālā and Oḍā: Khol is like a covered box and its inside is empty.¹⁵⁹ The word has come from Austric language family.¹⁶⁰ *Ḍālā* is a big box made of bamboo sheets,¹⁶¹ kind of a big basket. The part of the *Ghāni*, which is known as a *Ḍālā* in Dinajpur, is similar to a basket made of bamboo. But the *ḍālā* of *Ghāni* made of bamboo can still be seen.¹⁶² This word has come to Bāṅglā from Austric-Saontali language. Again the *Ḍālā* of *Ghāni* is known as *Oḍā* in Jessore. In Bāṅglā the meaning of *oḍā* is a basket made of bamboo or wood. Kṛtibās Ojhā (c. 1381-1461 CE) has used *oḍā* in his *Rāmāyaṇa*.¹⁶³ Considering these it is logical to consider *khol* or *ḍālā* as indigenous words.¹⁶⁴

Māhaḍi,¹⁶⁵ Ḍagi, Mākaḍi: In the Varendra region *ḍaṅgā* or *ḍaṅgi* is a kind of vessel. These words are related to the word *doṅgā*, which is an Austric word. On the other hand *māhaḍi* and *mākaḍi* is now known, in standard Bāṅglā as *mākaḍi*. *Mākaḍi* is a kind of ear ornament. But the specialty of this ornament is that it engulfs the upper part of the ear. According to Khudiram Das the word *mākaḍi* has come from the Saontali word *maḍi* or *maukaḍi*. In Saontali language the meaning of the word refers to an ornament, which is worn in the upper part of the ear.¹⁶⁶ Here it can be restated that *dogi*, *māhaḍi* or *makaḍi* of a *Ghāni* is of the same shape and it is attached with the head of the *Jait*.

Tisi and Til: *Tisi* is a kind of oil seed (linseed). The word is of Austric origin.¹⁶⁷ Similarly *Til* is another kind of oil seed (sesame) and the word is of Dravidian origin. The word is found in Tamil, Malayalam, Kannarese languages having the same meaning.¹⁶⁸ It may be mentioned here that the word *tel* (oil) has evolved from the word *til*.¹⁶⁹

Khail: It is the residue of oil seeds, that is left after the extraction of oil. In Bāṅglā dictionaries *Khail* is said to have originated from the Sanskrit word *Khali*. But the word seems to be older and found in the Saontali language as *khaudi*, which bears the same meaning (oil-cake).¹⁷⁰

Sariṣā: This Bāṅglā word has been derived from the Sanskrit word *Sarṣapa*.¹⁷¹ *Sarṣapa* is found mentioned in the *Arthaśāstra* and *Abhidānaratnamālā*.¹⁷²

We have mentioned earlier that so far no physical evidence of a *ghāni* has yet been found in ancient India. But in Sanskrit literature of about 500 BCE there is mention of grinding of oilseeds.¹⁷³ In the *R̥gveda* there is mention of two devices called *ulukhala* or *musala* and *gravaṇa*. A part of a grinding device found from Gujarat appears to be an ancient version of the *ghāni*.¹⁷⁴ So it appears to us that the *ghāni* was in use in early Bengal region.

It is an accepted fact that the earliest settlers in Bengal were using Austric-Dravidian languages before the coming of the people with Brahmanic culture.¹⁷⁵ At present the Mundari language— the language of the Saontals, Mundas, Korwas and Korbus— represents the Austric linguistic group. The Dravidian group of languages is represented by the Gond, Maler, Kui (*khanda*) and Orāon (*kuḍukh*) languages.¹⁷⁶ The other ancient language used by the people of this region was Bhoṭ-chinese or Bhoṭ-Brahma, which is represented by the present day *Mec*, *Barā*, *Rābhā*, *Tipurā*, *Bodo* etc. languages.

As we find that almost all the words connected with the traditional agricultural technology, such as *lāṅgal*, *hol*, *īs*, *cuḍā*, *phāl*, *pāśi*, *gādā*, *don*, *ḍāb*, *seunti*, *āuḍi*, *kuṭi*, *golā*, *ḍābar*, *maṭkā*, *dhenki*, *cāul*, *kuṭā*, *āleni*, *salā*, *kulā*, *udkhal*, *ghāni*, *kalu*, *ḍālā*, *mākaḍi*, *coṅgā*, *nalī*, *til*, *tisi*, *khail* etc. were derived from the pre-Aryan group of languages and they were in use in the early and early medieval period. We can possibly safely say that the pre-Aryan people of the Bengal region were deeply connected with the evolution of agricultural technology in the region.

One important feature of traditional agricultural technology was the use of locally made equipments made of locally available raw materials. Most of the equipments were reusable. After long use of the equipments when they became redundant, they could be used as fuel. The equipments

and the technology was evolved by local people for their own use and as a result they were very much environment-friendly. The basic raw materials used for the agricultural equipments were wood and bamboo, which were abundantly available locally. The little amount of iron that was used were also available in Bengal. Probably before the advent of iron, hard wood or stone pieces were used instead of iron.

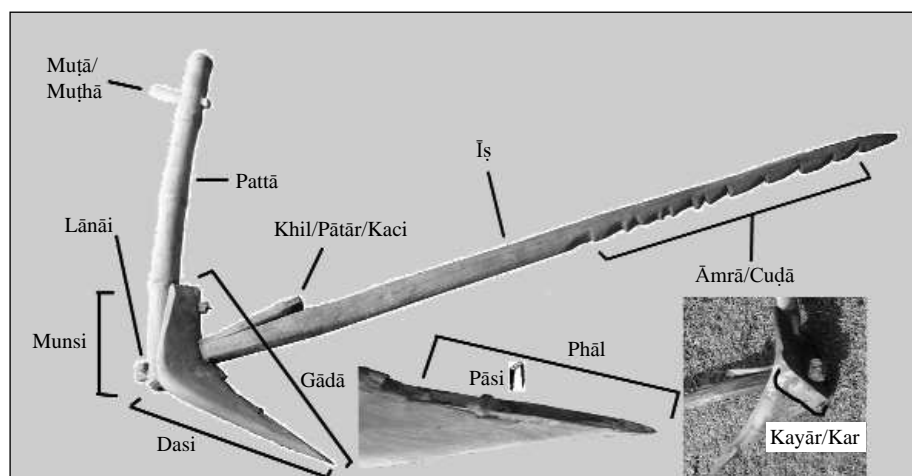
The *lāṅgal* played the pivotal role in agriculture. It was developed by the local people. Initially they possibly used sharp hard wood for tilling the soil. Later stone or iron coulter was added which practically revolutionised the tilling technology. The addition of *iṣ*, *joāl*, *bidā* and *mai* (ladder) helped increase the effectiveness of the *lāṅgal* (plough). In tilling the soil of a small area the role of the *kodāl* (spade) was highly effective. The use of the ladder (*mai*) to make the tilled soil surface smooth was definitely an innovation of the local agriculturists. The use of different kinds of irrigation equipments clearly prove the innovativeness of the local farmers. They evolved the equipments to suit the local condition and the local needs. The local people showed their innovativeness not only in the production of various kinds of agricultural products, but also in evolving various techniques and equipments in grinding the crops, the oil seeds etc. Their genius is clearly proved by the complex functions of the *dhenki*, *ghāni* and other similar equipments. The technology of tilling the soil, sowing the seeds, preservation of seeds, grinding the various agricultural products were all evolved by the local farmers with local raw materials, to suit the local environment and natural conditions. The technology was developed over a long period of time through experimentations carried out by local farmers.



Pl. 1: Plough, Sylhet. [Courtesy: M. Ali].



Pl. 2: Plough in Egyptian Painting.



Pl. 3: Different parts of plough.



Pl. 4: Wooden *Don*.



Pl. 5: Water lifting by *Dāb*.



Pl. 6: *Sewti* made of bamboo.



Pl. 7: Water lifting by *Sewti*.



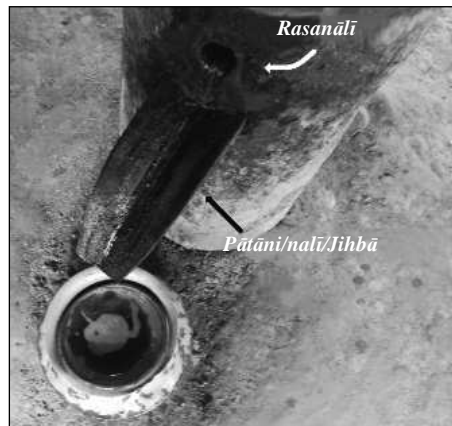
Pl. 8: *Auḍi*.



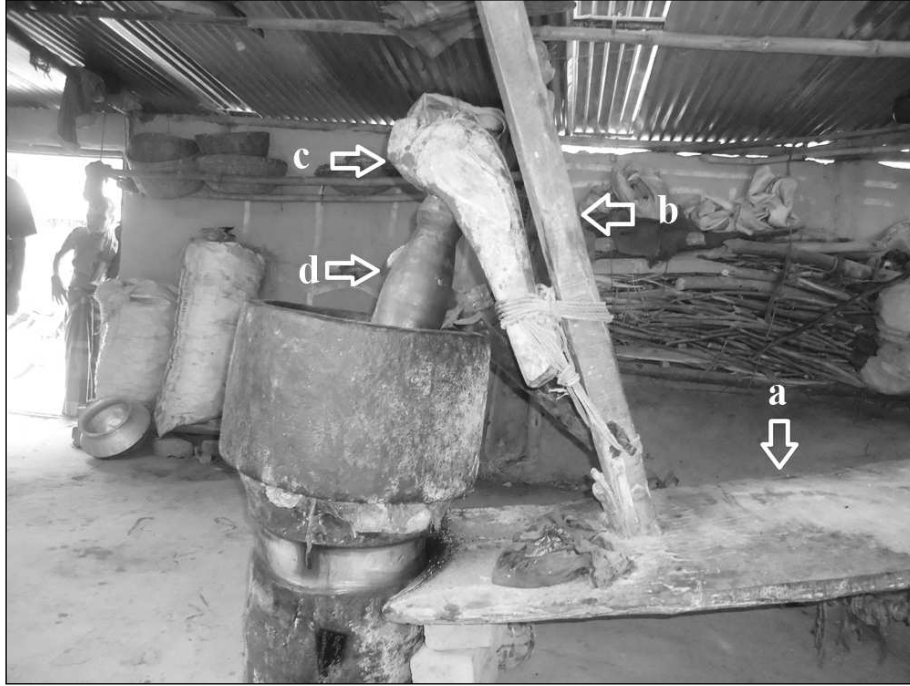
Pl. 9: *Kolā*.



Pl. 10: *Marāi*. Bardhaman. [Courtesy: S. Thakur].



Pl. 11: *Rasanālī*, *Patani* of a *Ghāni*.



Pl. 12: Different sections of *Ghani*: a. *Kātāri*, b. *Matam*, c. *Māhḍi*, d. *Jait*.

Notes and References

- 1 Basically this gap is constructed by the conservative definition of the elements of history. See, Jatin Sarkir, 'Itihās Guru Rabindranāth', *Itihās*, Vol. 13, Baishakh-Chaitra 1386 BS, Dhaka, 1981: 33-35.
- 2 He has described the counting method of ancient Bengal, names of different crops and vegetables, place-names, the staple food of the Bengali people etc, on the basis of the words used by Austric and Dravidian Language family. See, Niharranjan Ray, *Bāṅgālir Itihāsa: Ādiparva*, 1402 BS: 43, 49, 51, 443 and 447.
- 3 In this context historian Irfan Habib has given much importance to the analysis of Etymology. See, Irfan Habib, *Sindhu Shabhytā* (trns. Kaberi Basu), Kolkata 2009: 112-116; *The Horse, the Wheel, and Language: How Bronze-Age Riders from the Eurasian Steppes Shaped the Modern World*, Princeton and Oxford, 2007.
- 4 Niharranjan Ray mentioned that the glimpses of everyday life in ancient Bengal can be traced in such words of Austric and Dravidian languages that are still present among us. Considering this fact these words are our dependable evidences as well. See: Niharranjan Ray, *Bāṅgālir Itihāsa*: 442.

- 5 Controversial opinions are there about its date. But according to many *Kṛṣi Parāśara* was written in between 6th to 10th century. *Kṛṣi-Parāśara*- the composition of agricultural policy which is in Sanskrit language, was written for the benefit of farmers. It seems from the description of nature and agriculture mentioned in the book that Ṛṣi Parāśar, was a man from Bengal or Eastern India. Among the 143 verses of the book first 9 describe the importance of agriculture and farmer. Next important issue is determining the timing of farming. Next 70 verses describe cloud, nature and amount of rain in a month. Verse 80-84 describe the quality of persons involved in cultivation and next verses up to verse no 111 elaborate how to determine animals in farming, how to nurse them. Next nine verses (112-120) elucidate various parts, size, shape, materials and measurement of *lāṅgal*. Preservation of seeds, seeding techniques, nursing of plants and harvesting paddy are described in the verses from 157 to 213. Rest of the verses describe establishment of *medi*, wood of *medi* and fixation of time, measurement and conservation of crops. See, Girija Prasanna Majumdar and Sures Chandra Banerji (ed. and trans.), *Kṛṣi-Parāśara*, Calcutta, 1960; Upinder Singh, *A History of Ancient and Early Medieval India*, Delhi, 2009: 30; Ryosuke Furui, 'The Rural World of an Agricultural Text: A Study on the *Kṛṣi-Parāśara*', *Studies in History*, 21, 2 n.s. (2005): 149-171.
- 6 See Aniruddha Das, *Dirghasthāyī Kṛṣi Bikāś:Aitihāsik Paṭabhumi O Ādunik Sabhyatār Dāy*, Calcutta, 2010: 19-28.
- 7 Niharranjan Ray, *Bāṅgālir Itihāsa*: 64.
- 8 Enamul Haque, *Chandraketugarh: A Treasure-house of Bengal Terracottas*, Dhaka, 2001: 316-317.
- 9 D.C. Sircar, *Select Inscriptions Bearing on Indian History And Civilization*, Vol. I, Calcutta, 1965: 79; 'Mauryan Brahmi Inscription of Mahasthan', *Epigraphia Indica (EI)*, Vol. XXI, 1931-32: 83-91; 'Mahasthan Brahmi Inscription', <http://en.banglapedia.org/>.
- 10 Niharranjan Ray, *Bāṅgālir Itihāsa*: 66.
- 11 Patañjali, *Vyākaraṇ-Mahābhāṣya: Paspāśāhnikā*, (ed. and trans. by Dandisami Damodar Asram), Kolkata, 1925 Śakabda:198 and 199.
- 12 He describes Puṇḍravardhana as: The soil is flat and loamy, and rich in all kinds of grain production. See, Samuel Beal, *Buddhist Records of The Western World, Vol. II*, London, 1884: 194.
- 13 It is mentioned in the 10th line of the Bappaghoshavata copper plate of Jayanāga. See, *EI*, Vol. XVIII (1925-26): 63.
- 14 In the 4th and 10th line of Anuliya copper plate of Lakṣmaṇasena and 24 line of Edilpur copper plate of Keśavsena. See, Nani Gopal Majumdar (ed.), *Inscription of Bengal, Volume III*, Rajshahi, 1929: 88-90, 129.
- 15 Ali Nawaz opines that Khanā was before 7th century CE and in *Banglapedia*, it is mentioned that these were composed in between 8th and 12th CE century. See, Ali Nawaz, *Khanār Bacan: Kṛṣi O Kṛti*, Dhaka, 2014: 42-77; "Khona", <http://en.banglapedia.org/>.
- 16 See, *Khanār Kṛṣi O Phal Saṅkrānta Bacan*, Dhaka, 2011: 70, 73; Tushar Kanti Pande (ed.), *Cāṇakya Śloke, Sātsho Prabād O Khanār Bacan*, Calcutta, 2002: 45.
- 17 Madagurunath Bidyanidhi Bhattacharya (ed.), *Raghuvamśa*, Calcutta, 1383 BS., 170 and 71.
- 18 Sandhyākaranandī (c.1084-1155 CE) in the 3rd section of the *Rāmacarita* mentioned: (Varendri) which was (esteemed as) the sparkling crest-jewel of the earth because of (the

presence of) Lakṣmi (beauty) whose lovely form was beheld in the paddy plants of various kinds, which was further expanded by the fine bamboo clumps, and which had (as additional charm) the sugarcane plants that were flourishing excellently there (V.17 A). See: R.C. Majumdar, Radhagovinda Basak & Nanigopal Banerji, *The Rāmacaritam of Sandhyākaranandī*, Rajshahi, 1939: 91.

- 19 Madagurunath Bidyanidhi Bhattacharya (ed.), *Amarakoṣa*, Calcutta, 1417 BS: 106.
- 20 *Kṛṣi-Parāśara*, verse 157-167.
- 21 Rāmāi Paṇḍita, *Śūnya Purāṇa*, *Atho Chāṣa*: 27 (ed. Charuchandra Bandyopadhyay and Compilation Nimaichandra Pal), Calcutta, 1420 BS: 123 and 124.
- 22 Plough based agriculture means farming with animals and the traditional plough.
- 23 Nazrul Islam, *Bāṅglādeśer Grām: Atīt O Bhabīsyat*, Dhaka, 2011: 62.
- 24 *Ibid.*: 43.
- 25 *Ibid.*: 62.
- 26 R.C. Majumder and Niharrajan Ray are among the supporters of this opinion, though Majumder's view is not very clear. See, Nazrul Islam, *Bāṅglādeśer Grām*, 2011: 45.
- 27 D.D. Kosambi expressed the view that there was no such big local settlement in India except the Indus Valley. It was almost impossible with their tools to clear the jungle and start farming. He also thought that plough based agriculture was not practiced in Indus Civilization. See, Damodar Dharmanand Kosambi, *An Introduction to the Study of Indian History*, Bombay, 1975: 68, 75, 113.
- 28 It is worth mentioning that such *lāṅgal* is not in *khunti* shape. It is almost like the present-day plough.
- 29 Atul Sur, *Bāṅglā O Bāṅgālir Samāj O Saṁskṛti*, Calcutta, 1990: 99.
- 30 Wakil Ahmed, *Lakagñān O Lakaprayukti*, Dhaka, 2010: 16.
- 31 Atul Sur, *Bāṅglā O Bāṅgālir Samāj O Saṁskṛti*: 99. See also, *Al-Qur'an*, Surah Al-Baqarah, Ayat 223.
- 32 Eight parts are: *Īṣa*, *Yuga*, *Hāla-stanu*, *Niryolā*, *Pāsikā*, *Āddacala*, *Saula* and *Paccan*. See, *Kṛṣi-Parāśara*, Verse 112.
- 33 Rāmāi Paṇḍita, *Śūnya Purāṇa*:123, 124. Although there is difference among the scholars regarding the time of the author. Paresh Chandre Bhattacharya placed him in between 9th to 16th centuries. Wakil Ahmed expressed that he was a man of 13th century. See, Zaharaby Ripon, *Madhyajuger Pāñcālī Nāṭye Bāṅglār Kṛṣi-Prasaṅga*, Dhaka, 2010: 52.
- 34 Exmaples: *Purnimāy Amāy je dhare hāl / Tār dukho sarbakāl //*; *Khanā bale śuna kṛṣakgan/ Hāl laye māṭhe jābe jakhan// Śubha Kṣaṇ dekhe karbe jātrā/ Pathe jen nā hay aśubha bārtā//Māṭhe giye āge dik nirūpan/ Purba dik hate kara hāl cālan// Theke balad nā bay hāl/ Tār dukha sarbakāl// Tār Ardhek dhān/ binā cāṣe pān// Sonār put sonār lāṅgal/ erāi cāsār āne maṅgal/ lāṅgale na khudle māṭi/ mai nā dile paripāṭi// Fasal hay nā kānnākāṭi//; hāte dhire hāl cās/ śutile sarbnās//. See Ali Nawaz, *Khanār Bacan* : 187-189, 196, 198; *Khanār Kṛṣi O Phal Sankrānto Bacan*: 19, 64, 65, 72, 92; Tushar Kanti Pande, *Cāṇakya Śloke*: 32, 33.*
- 35 Nazimuddin Ahamed, *Mahāsthan Maināmati Pāhārpur*, Dhaka, 1997: 109
- 36 Tofayal Ahmed Dewan, 'Rānir Bānglo Dhibite Sāmprati Ābiṣkṛita Poḍāmātir Phalak', *Pratnacarcā-2*, Dhaka, 2008: 75 and 80.

- 37 'Dhulla Plate of Śricandra', *EI*, Vol. XXXIII (1959-60): 137.
- 38 'The Bhatera Copper-Plate Inscription of Govinda-keśavadeva', *EI*, Vol. XIX (1927-28): 285.
- 39 J. Przyluski, 'Non-Aryan Loans in Indo-Aryan', *Pre-Aryan and Pre-Dravidian in India* (Translated into English by P.C. Bagchi), Calcutta, 1929: 8-15.
- 40 *Ibid.*
- 41 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār: Anārjavāṣi Janagoṣṭhīr Prabhāv*, Dhaka, 2013: 287.
- 42 Vāsudev and Rohini was his parents and he was elder brother of Śrī Kṛṣṇa. See 'Balarām', *Paurāṇik Abhidhān* (compilation Sudhirschandra Das), Calcutta, 1412 BS.
- 43 'Hal', *Deśi Bāṅglā Śabder Abhidhān*, (Rabisankor Maitrey comp. and ed.), Dhaka, 2001.
- 44 'Hāl', *Sāontāli Bāṅglā Samaśabda Abhidhān* (Comp. Khudirām Das), Calcutta, 1998.
- 45 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*, 2013: 89.
- 46 Nazrul Islam, *Bāṅglādeśer Grām*, 2011: 45.
- 47 'Iṣi', *A Santali-English Dictionary* (by A. Campbell), Manbhum, 1899; 'Isi', *Sāontāli Bāṅglā Samaśabda Abhidhān*.
- 48 'Āmra' and 'Chuḍa', *Bāṅglādeśher Āñcalik Bhāṣār Abhidhān* (ed. Muhammad Shahidullah), Dhaka, 2009.
- 49 'Lāṅgal', *Bibartanmulak Bāṅglā Abhidhān* (Vol. III), Dhaka, 2014.
- 50 'Chuḍā', *Saontāli Bāṅglā Samaśabda Abhidhān*.
- 51 It is mentioned in *Kṛṣi Parāśara* that the *phāl* will be like the swallow-wool (*arkapatra*), its length will be 9 fingers or one arm (18 inches) or one and five fingers and the length of the *Pāsi* will be 12 fingers. See: *Kṛṣi-Parāśara*, verse 117 and 114.
- 52 Atul Sur, *Bāṅglā O Bāṅgālir Samāj O Saṃskṛti*: 104.
- 53 Maharsi Manu, *Manusamhitā* (ed. Manabendu Bandyopadhyay Sastri), 1419 BS: 1038 and 1039.
- 54 *Ibid.*: 42
- 55 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 264.
- 56 'Pasi, Phaosi', *Saontāli Bāṅglā Samaśabda Abhidhān*.
- 57 Niharranjan Ray, *Bāṅgālir Itihās*: 51.
- 58 'Gauḍi', *Sāontāli Bāṅglā Samaśabda Abhidhān*.
- 59 For details see, R. Balasubramaniam, 'Metallurgy of Ancient Indian Iron and Steel', in Helaine Selin (ed.), *Encyclopaedia of the History of Science, Technology and Medicine in Non-Western Cultures*, Dordrecht, 2005.
- 60 Dilip Kumar Chakrabarti, 'Pratnatāttvik Carcā: Prāgaitihāsik Yug Theke Prāk-madhyayug', *Bāṅglādeś Sāṃskṛtik Samikṣāmālā-1: Pratnaattvik Aitihiya* (ed. Sufi Mostafizur Rahman), Dhaka, 2007: 4. See for more details in this issue: Dharma Pal Agrawal, *Ancient Metal Technology and Archaeology of South Asia: A Pan-Asian Perspective*, New Delhi, 2000; B. Sasisekaran, 'Metallurgy and Metal Industry in Ancient Tamilnadu- An Archaeological Study', *Indian Journal of History of Science*, Volume 37 Issue 1, New Delhi, 2002: 17-29; B Prakash, 'Ancient Indian Iron And Steel: An Archaeometallurgical Study', *Indian Journal of History of Science*, Volume 46 Issue 3, 2011: 381-410.
- 61 Abdul Momin Chowdhury, 'Bāṅglāy Islām-Bistārer Patabhūmi', *Bangladesh Asiatic Society Patrikā*, Vol. IV, December 1986: 62.
- 62 According to Niharranjan Ray Iron tools were used in Bengal in the 6th/7th century BCE. See, Niharranjan Ray, *Bāṅgālir Itihāsa*: 66.

- 63 Muhammad Shahidullah, *Bāṅglā Bhāṣār Itibṛtta*, Dhaka, 2010: 58; A. Momin Chowdhury, *Prācīn Bāṅglār Itihās O Saṃskṛti*, Dhaka, 2012: 99.
- 64 Ibn Batutta saw water weels in the two sides of Megna river which seems illogical. Because no other sources of medieval period describe water weels. It is a machine used in the other parts of India. On the basis of this description M.R. Tarafder wrote that “ the machine was used successfully to give water in the plain ploughable land of eastern Bengal. See, *Travels of Ibn Battuta* (trans. Iftekhār Amin), Dhaka, 2009: 221; Momtazur Rahman Tarafdar, *Madhyayuger Bāṅglāy Prayukti O Samāj Vivartan*, Dhaka, 1993: 31.
- 65 Irfan Habib, *Tecnology In Medieval India, c. 650-1750*, New Delhi, 2009: 8-15; Irfan Habib, *Mughal Bhārater Kṛṣi Byābasthyā (1556-1707)*, Calcutta, 1999: 14-16.
- 66 ‘Naukā’, *Laukik Gñānakoṣ* (Wakil Ahmed ed.), Dhaka, 2011; Sukhamay Mukhopadhyay, *Bāṅglār Itihāsa*, Dhaka, 2005: 620.
- 67 Sandhyākaranandī in the third chapter of the *Rāmacaritam* mentioned: (a) That king, Rāma made the ocean itself, with the great construction of a causeway with the chains of large mountains and palm trees, filled up like an ordinary tank. (b) That king (Rāmapāla) constructed great works of public utility in the shape of large lakes with tall palm trees and lines of hillocks on their border, so as to make them look like veritable seas. (V 42); Lakṣman Sena court poet Dhoyī mentioned in his *Pavanaduta* that Brāhamaṇa women used ornaments made of soft palm leaf. Duarte Barbosa also mentioned that wine produced in Bengal is made of sugar and palm tree juice, *The Rāmacaritam*, 1939: 108; Zaharaby Ripon, *Madhyajuger Pāñcālī*, 2010: 29; Sukhamay Mukhopadhyay, *Bāṅglār Itihāsa*: 631 and 645; Ashim Kumar Ray, *Baṅga Bṛttānta*, Dhaka, 2015: 129.
- 68 Mr. Altaf Hussain (Malahar, Dhamirhat, Naogaon) has kept a wooden *don* in his house Measuring 13f. 7 in. length, 27-33 inc in width and 0.75 in is the thickness of the wood. The *don* 40/45 years old and made of wood of Mango tree, the *Kholash* is 7-9 in. in width. Information collected by the present author on 13 February 2012.
- 69 Information collected by the author.
- 70 Sirajul Islam Chowdhury, *Arthanaitik Bhūgol: Viśva O Bāṅglādeś*, Dhaka, 2003: 110.
- 71 “Agriculture [Technology Used in Agriculture]”, <http://en.banglapedia.org/>. However the amount of water may be different. It depends on the ability of the person and height of the water.
- 72 *Banglapedia* termed it as ‘Doph’ and the local people called it *Kerka*. But the word *dāb* is used in Naogaon district.
- 73 ‘Dol’, *Laukik Gñānakoṣ*: 2011.
- 74 Kari W. Butzer, *Early Hydraulic Civilization in Egypt: A Study in Cultural Ecology*, Chicago and London, 1976: 46.
- 75 They gave the name of *Shaduf/Shadouf/Shadoof*. See: <http://www.irrigationmuseum.com/exhibit2.aspx>.
- 76 *Ḍāb* can lift 16-20 liters water. Information relating to this were collected by the author himself.
- 77 Ḍombī’s 14th *caryā*, see Ebadat Hossain, *Caryā Pariciti*, Rajshahi, 1991: 80.
- 78 It has several local names, such as *Seuti*, *Heot*, *Sechni*, *Ucha*, *Hocho*, *Uchi*, *Shayot*, *Uri*, *Ḍobki*, *Heith*, *Hichuni*, *Ichuni*, *Lui*, *Duri*, *Jhajra*, *Ḍobka* etc. See: “Agriculture [Agricultural machinery]”, <http://en.banglapedia.org/>.
- 79 “Agriculture [Technology Used In Agriculture]”, <http://en.banglapedia.org/>.
- 80 Ebadat Hossain, *Caryā Pariciti*: 80.

230 HISTORY OF BANGLADESH

- 81 *Kṛṣi-Parāśara* provide examples of the use of local knowledge. For detail see, Furui, 'The Rural World of an Agricultural Text': 149-171.
- 82 *Kṛṣi-Parāśara* suggest that the paddy-seeds should be dried in the months of *Māgh* and *Phālgun*; bran of seeds should be cleaned and then preserved in small jars. See, *Kṛṣi-Parāśara*: verse 157-167.
- 83 *Byābahārik Bāṅglā Abhidhān*, Dhaka, 2003.
- 84 'Auḍi', *Bāṅglādeśer Āṅcalik Bhāṣār Abhidhān*.
- 85 'Āḍac', *Sāontāli Bāṅglā Samāśabda Abhidhān*.
- 86 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 128.
- 87 'Kuṭi', *Bāṅglādeśer Āṅcalik Bhāṣār Abhidhān*.
- 88 'Kuṭhi', *Laukik Gñānakoṣa*.
- 89 This information was collected by the author on 8 August 2012.
- 90 *Byābahārik Bāṅglā Abhidhān*.
- 91 'Gul', *Saontāli Bāṅglā Samāśabda Abhidhān*.
- 92 *Byābahārik Bāṅglā Abhidhān*.
- 93 *Ibid*.
- 94 'Dābar', *Bāṅglādeśer Āṅcalik Bhāṣār Abhidhān*.
- 95 'Dābar', *Saontāli Bāṅglā Samāśabda Abhidhān*.
- 96 *Byābahārik Bāṅglā Abhidhān*.
- 97 'Ḍulā', *Bāṅglādeśer Āṅcalik Bhāṣār Abhidhān*.
- 98 'Ḍuli', *Prācīn O Madhyajuger Bāṅglā Bhāṣār Abhidhān: Vol. I* (Comp. and eds. Muhammad Abdul Qayyum and Razia Sultana), Dhaka, 2007.
- 99 'Bhāḍ', *Byābahārik Bāṅglā Abhidhān*.
- 100 *Ibid*.
- 101 'Maṭki', *Bāṅglādeśer Āṅcalik Bhāṣār Abhidhān*.
- 102 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 274.
- 103 *Ibid*.: 178.
- 104 'Marāi', *Baṅgiya Lokosaṃskṛti Koṣa* (ed., Barunkumar Chakraborty), Kolkata, 2016: 445.
- 105 'Marāi', *Prācīn O Madhyajuger Bāṅglā Bhāṣār Abhidhān*, Vol. II.
- 106 Wakil Ahmed, *Lokagñān O Lokaprayukti*: 25.
- 107 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 209.
- 108 'Mocā', *Bāṅglādeśer Āṅcalik Bhāṣār Abhidhān*.
- 109 'Mocā', *Laukik Gñānakoṣa*.
- 110 'Myāta', *Bāṅglādeśer Āṅcalik Bhāṣār Abhidhān*.
- 111 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 277.
- 112 'Hāṇḍā or Hāṇḍi', *Saontāli Bāṅglā Samāśabda Abhidhān*.
- 113 Sufi Mostafizur Rahman, 'Mritpātra', in Sufi Mostafizur Rahman (ed.) *Bāṅglādeś: Sāṃskṛtik Samikṣāmālā-1: Pratnatāttvik Aitihya*, Dhaka, 2007: 142.
- 114 Habibur Rahman, *Itākhola Bihār*, Dhaka, 1997: 17; Sufi Mostafizur Rahman, 'Mritpātra', 2007: 139; Md. Shafiqul Alam, *Paharpur and Bagerhat: Two World Cultural Heritage Sites of Bangladesh*, Dhaka, 2004: 14.
- 115 Wakil Ahmed, *Lakagñān O Lakaprayukti*: 28.
- 116 Shidharta Ghosh, *Kāler Kolkata*, Kolkata, 2015: 46; Jitendranath Ray, *Bāṅglār Kalkārkhanā O Kārigari Bidyār Itihās*, Kolkata, 2005:190; Nirmalkumar Basu, *Bhārater Grām-Jiban*, Kolkata, 2008: 43.

- 117 Wakil Ahmed, *Lokagñān O Lokaprayukti*: 31; Muhammad Abdul Jalil, *Lokobigñān O Lakaprayukti*, Rajshahi, 2004: 38.
- 118 Rāmāi Paṇḍita, *Śūnya Purāṇa*: 92.
- 119 See: 'Dhenki' and 'Dhenki' *Prācin O Madhyajuger Bāṅgla Bhāṣār Abhidhān*, Vol. I; 'Pauā' *Prācin O Madhyajuger Bāṅgla Bhāṣār Abhidhān*, Vol.II; 'Nārada', *Paurāṇik Abhidhān*; 'Dheki', *Bibartanmūlak Bāṅglā Abhidhān (Vol. II)*, Dhaka, 2013.
- 120 Sahanara Husain, 'Saduktikarṇāmṛte Bāṅglār Grām', *Prācin Bāṅglār Itihās*, Rajshahi, 2012: 102 and 103.
- 121 Zulekha Haque, *Terracotta Decorations of Late Mediaval Bengal: Portayal of a Society*, Dacca, 1980: 61.
- 122 *Jaṭta* is mentioned by the 16th century poet Mukunda Rām Chakraborty. See: 'Jātā', *Bibartanmūlak Bāṅglā Abhidhān (Vol. I)*, Dhaka, 2013.
- 123 Rāmāi Paṇḍita, *Śūnya Purāṇa*:151.
- 124 'Baigram Copper-Plate Inscription of The (Gupta)- Year', *Epigraphia Indica*, Vol. XXI (1931-32): 83.
- 125 Tapati Rani Sarkar, *Bāṅgla Bhāṣār Śabdavāṇḍār*: 94; Rafiqul Islam, 'Bāṅgla Bhāṣāe Anārja Śabda', *Shāhitya Patrikā*, Vol. 38, No. 3, Ashar 1402: 63; 'Dheki' and 'Dheki', *Byabahrīk Bāṅglā Abhidhān*.
- 126 'Dhenki' and 'Dhenki', *Prācin O Madhyajuger Bāṅgla Bhāṣār Abhidhān*:Vol. I.
- 127 Husking pedal, *Tarāi-Duārser Lokāyata Śabdakoṣ* (Com. and ed. Krishnapriya Bhattacharya), Kolkata, 2006.
- 128 Krishnapriya Bhattacharya, 'Prāk Kathan', *Tarāi-Duārser Lokāyata Śabdakoṣ*: 30 and 31.
- 129 J. Przyluski, Jules Bloch and Sylvain Levi, *Pre-Aryan and Pre-Dravidian in India* (Translated into English by P.C. Bagchy), Calcutta, 1929: XXIV; Muhammad Shahidullah, *Bāṅglā Bhāṣār Itihāsa*, 2010: 57; 'Cāole', *Saontālī Bāṅglā Samaśabda Abhidhān*.
- 130 Tapati Rani Sarkar, *Bāṅgla Bhāṣār Śabdavāṇḍār*: 134.
- 131 'Ulāo', *Saontālī Bāṅglā Samaśabda Abhidhān*.
- 132 'Bhūṣou' and 'Salā', *Ibid*.
- 133 Tapati Rani Sarkar, *Bāṅgla Bhāṣār Śabdavāṇḍār* : 298.
- 134 'Gaḍh 2', *Saontālī Bāṅglā Samaśabda Abhidhān*.
- 135 Tapati Rani Sarkar, *Bāṅgla Bhāṣār Śabdavāṇḍār*: 69.
- 136 *Ibid.*: 58.
- 137 'Pāran', *Saontālī Bāṅglā Samaśabda Abhidhān*.
- 138 Tapati Rani Sarkar, *Bāṅgla Bhāṣār Śabdavāṇḍār*: 220.
- 139 *Bāybahārīk Bāṅglā Abhidhān*.
- 140 'Ukhuḍ', *Saontālī Bāṅglā Samaśabda Abhidhān*: 138; Husking Mortar, *Tarāi-Duārser Lokāyata Śabdakoṣ*.
- 141 'Āḍha-Āḍhi', *Saontālī Bāṅglā Samaśabda Abhidhān*.
- 142 Rafiqul Islam, 'Bāṅglā Bhāṣāy Anārya Śabda': 64.
- 143 Jitendranath Ray, *Bāṅglar Kalkārkhānā*, 189 and 190; Wakil Ahmed, *Lokagñān O Lakaprayukti*, 2010: 35; Muhammad Abdul Jalil, *Lokobigñān O Lakaprayukti*, 2004: 39, 40; Nirmalkumar Basu, *Bārater Grām-Jiban*: 50.
- 144 Wakil Ahmed, *Lakagñān O Lakaprayukti*, 2010: 36.

232 HISTORY OF BANGLADESH

- 145 *Ibid.*
- 146 *Ibid.*
- 147 *Ibid.*
- 148 *Ibid.*
- 149 Mukundaram Chakrabarti, *Caṇḍimaṅgal* (ed.) Sukumar Sen, New Delhi, 2013: 81.
- 150 *Ibid.*: 84.
- 151 For relevant verses, See Candidās, *Śrīkṛṣṇakīrtan* (Basantaranjan Ray Bidbadballabh), Kolikata, 1323 BS: 116, 318 and For modern version, See: Muhammad Abdul Hai and Aneer Pasha (ed.), *Baru Candidāser Kābya*, Dhaka, 2014: 242; ‘Telini’, *Prācin O Madhyajuger Bāṅglā Bhāṣār Abhidhān*, Vol. II.
- 152 ‘Ghāni, Ghāanu’, *Saontāli Bāṅglā Samaśabda Abhidhān*.
- 153 ‘Ghāni’ *Prācin O Madhyajuger Bāṅglā Bhāṣār Abhidhān*, Vol. I.
- 154 ‘Ghāni, Byābahārik Bāṅglā Abhidhān.
- 155 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*, 2013: 234.
- 156 ‘Kulhu’, *Saontāli Bāṅglā Samaśabda Abhidhān*.
- 157 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*, 2013: 137
- 158 ‘Kalu’, *Deśi Bāṅglā Śabder Abhidhān*.
- 159 ‘Khol’, *Saontāli Bāṅglā Samaśabda Abhidhān*.
- 160 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 141.
- 161 ‘Dālā’, *Saontāli Bāṅglā Samaśabda Abhidhān*.
- 162 Abdur Razzak (50), Vill. Alipur, Sibpur, Thana- Birampur, Dist.- Dinjpur still continues the Ghāni profession. On 19 July 2015, he informed that the author he used the *Dālā* made of bamboo. The picture of Ghāni with *Dālā* in Rangpur was published in monthly *Kiśor Ālo*. See, *Kiśor Ālo*, Vol. 3, No. 05, February 2016, Dhaka: 72.
- 163 ‘Oḍā’, *Prācin O Madhyajuger Bāṅglā Bhāṣār Abhidhān*, Vol. I.
- 164 ‘Khol or Dālā’, *Deśi Bāṅglā Śabder Abhidhān*.
- 165 Wakil Ahmed, *Lakagñān O Lakaprayukti*: 36.
- 166 ‘Makuḍi or Maukaḍi’, *Saontāli Bāṅglā Samaśabda Abhidhān*.
- 167 ‘Tisi’, *Saontāli Bāṅglā Samaśabda Abhidhān*; Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 165.
- 168 Tapati Rani Sarkar, *Bāṅglā Bhāṣār Śabdavāṇḍār*: 244.
- 169 ‘Tel’, *Bāṅglā Śabder Utsa-Abhidhān* (Forhad Khan), Dhaka, 2012.
- 170 ‘Khaḍi’, *Saontali Bāṅglā Samaśabda Abhidhān*.
- 171 ‘Sariṣā’, *Byābahārik Bāṅglā Abhidhān*.
- 172 M.S. Randhawa, *A History of Agriculture in India*, Vol. 1: 361 and 483.
- 173 K.T. Achaya, “Ghāni, the Indian Oilpress: An Ancient Technology”, *Current Science*, Vol. 64, No. 9, Bengaluru: Current Science Association & Indian Academy of Sciences, 10 May 1993: 693.
- 174 *Ibid.*
- 175 Atul Sur, *Bāṅgālir Nṛitāttvik Paricay*, Calcutta, 1977: 24 and 25; Suniti Kumar Chatterji, *Bāṅglā Bhāṣātattver Bhumikā*, Calcutta, 1934: 76.
- 176 Niharranjan Ray, *Bāṅgālir Itihāsa*: 42; Atul Sur, *Bangalir Nṛitāttvik Paricay*: 26; Krishnapriya Bhattacharya, ‘Prāk-Kathan’, *Tarāi-Duārser Lokāyata Śabdakoṣ*: 31 and 32.